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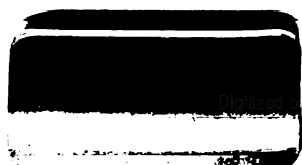
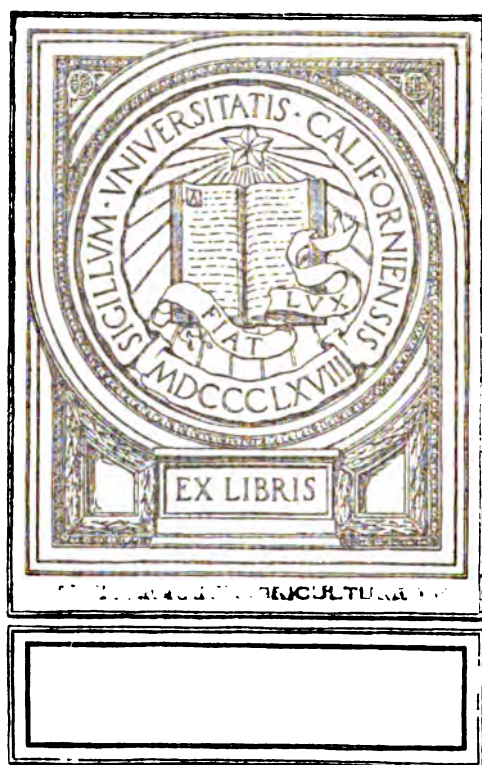
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INDIAN FORESTER;

A QUARTERLY MAGAZINE

OF

FORESTRY.



EDITED BY

J. S. GAMBLE, M.A., F.L.S.,

OFFICIATING CONSERVATOR OF FORESTS, BENGAL.



VOLUME VI.

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THE
INDIAN FORESTER.

Vol. VI.]

JULY, 1880.

[No. 1.

The Mulberry Tree as a source of Food for Silk-
Worms.

BY C. H. LEPPER, F.R.G.S., M.B.A.S.

WHEN I commenced this little pamphlet I had not intended enlarging upon the Mulberry Tree, but as the subject grew I began to think that a few words on the food-supply, whilst yet on the trees, would not be out of place, though in the standard French Works on Silk-Worm Rearing the Mulberry finds but little attention given it. Gradually I came to the decision that, as the experiment, in the interests of which this pamphlet is published, is to be undertaken and in part carried on by inexperienced though enterprising people, I ought to devote a considerable portion of the pamphlet to the Mulberry, to assist the enterprise from the very beginning as much as possible. Then, remembering the great dearth of scientific classification, or perhaps it would be more correct to say the over-classification of the different so-called varieties of the Mulberry tree, and remembering that as a food-supply for worms *local* conditions require special attention in selecting the most suitable kind of Mulberry tree, I began to fear that I might only create confusion in the mind of the reader, and possibly distrust or want of confidence in the experiment, and thus commence by prejudicing people against what it was my very object to attract them in favor of, viz., Silk-rearing in Northern India. This I feared the more as, knowing there had been no scientific or technical attention paid to the special *local* conditions, I should be powerless to name what varieties should be planted and in what manner cultivated. Then, on further consideration, I decided that it was best to place the whole subject fairly before the reader to the best of my ability, in the certainty that those who would have been happy to blindly follow a leader, on his simple statement, would not be deterred from starting on a track of their own when attracted by the desire to succeed, and guided by the light of their own experience, assisted as much

as I can assist them by what information I can afford of the manner of proceeding in *other* countries.

I thus leave them free choice to select any or all of the different systems employed and free to compete with each other for the greatest share of success.

I would merely mention in passing that Tea began under similar conditions, and its present position amongst the Industries of India justify me in hoping that sufficient enterprise will be shown to give sericulture a fair chance of developing the great future I feel certain would, in that case, open out for it—a future that cannot but be tempting to owners of land in suitable localities, when it is remembered that the whole year's labour is condensed into two months, from which profits should be obtained quite equal to what the majority of Tea companies can show after working throughout the whole twelve.

When it is remembered too that, so far as Dehra Dún is concerned, and possibly Kangra Valley also, the silk-season happens just at the Tea-planters' slack time, when labour is usually plentiful, and that silk-rearing may be undertaken without clashing with the interests of their Tea-plantations, and serve indeed as a means of finding employment and so of retaining for the Tea-season, what might otherwise for the time prove surplus labour, surely many owners will be found anxious to fathom the merits of such a tempting investment. Then, again, many must own land unsuited for Tea, yet possibly perfect for Mulberry cultivation.

There are many so-called varieties of Mulberry trees, and many more sub-varieties, and these are in some cases known by different names among botanists. It would be practically useless giving all the names of the various kinds here, and would only lead to confusion and a useless enlarging of this little monograph.

In order, however, to prove that I am not thus trying to shirk the trouble which might be thought was my object in thus omitting what some might think an important piece of information, I will just give a few examples of the confusion that exists amongst botanists, &c., and thus leave the reader to see for himself how little good would come of mentioning all the so-called varieties.

Firstly then, Dr. Brandis in his *Forest Flora of North-West and Central India*, says on page 408, speaking of the Mulberry tree: "The chief product of this tree, however, in the Punjab, Beluchistan and Afghanistan, is the fruit, of which there are many varieties, sweet and acid, and of all shades of colour, from white to a deep blackish purple. The large white kind of the Peshawar Valley (*Shah Tút*) is one of the best. The following kinds are cultivated in Beluchistan, according

"to Stocks : *Siah*, colour black and white mixed ; *Bedana* (seedless) ; *Pewandi* (grafted), with delicious pearly small white fruit ; *Shah Tūt* (Royal Mulberry) ; *Khar Tūt* (Jackass Mulberry.) It remains for further inquiry on the spot which of these varieties should be classed under *M. alba* and *nigra*, and "it is not impossible that it may, in the Punjab and Afghanistan at least, be found impracticable to maintain the distinction between the two species."

Then again in describing *Morus indica*, Dr. Brandis says, page 408, of his *Forest Flora* : "Leaves pubescent when young, rough afterwards, with minute round raised dots, &c., &c.," whereas the late Dr. Roxburgh, in his *Flora Indica*, page 659, says of the leaves, in describing the same tree : "*Smooth on both sides* !,"*

Then again Dr. Brandis, on page 408, speaking of *Morus indica*, says : "Dr. Stewart considered this as merely a variety of *M. alba* ;" and on page 409, speaking of its habitat, names *Japan* ; yet in the Report of the Italian Commission to Japan, as quoted later on in this pamphlet, it is distinctly asserted there is no *White Mulberry* in Japan ! Roxburgh gives 7 varieties, Count Dandolo 18, and Dr. Brandis, probably recognizing the impossibility of distinguishing what may now simply be the effects of cultivation, leaves most of his varieties unclassified, botanically speaking, as quoted above. Then, again, the distinctive marks between the Black and the White Mulberry are so very slight, and the uncertainty that must exist when trying to decide from a specimen whether such distinctive marks in the specimen under observation are permanent characteristics of the tree to which it belonged, renders true classification particularly difficult, save perhaps to a local observer well up in the special study of Mulberry trees. This difficulty again is not diminished by the fact that there are four kinds of *White Mulberry* in the matter of colour of fruit, two kinds bearing white or whitish fruit, one red and one black ! Dr. Brandis, in the quotation I have given above, gives the *Shah Tūt* as one of the best for fruit in the Peshawar Valley. This agrees with the native opinion in the Dehra Dūn, which also gives the preference to the leaves of the *Shah Tūt* for food for silk-worms ; whereas in the Gurdaspur District of the Punjab the natives, according to information conveyed to me, prefer the fruit of the *Bedana* to eat as being sweeter than that of the *Shah Tūt*, although the latter bears the largest fruit. In the Gurdaspur District, too, they prefer the leaf of the *Bedana* and the *Khatta Tūt* to that of the *Shah Tūt*, as being more tender for the worms, although they say, that when within eight days of spinning their cocoons the worms seem to take as readily to the *Shah Tūt* as to the others.

* These italics are mine.—C. H. L.

I think I have sufficiently exemplified the reasons I have given for not going too minutely into a description of varieties. It seems a great pity that a tree that might some day prove of such importance in parts of India, has not received the attention of really scientific botanists, which it unquestionably merits.

Since the Mulberry tree first became cultivated in France for sericultural purposes, ideas as to the different kinds thought best suited have been subject to several changes. *Morus nigra*, *M. multicaulis* (sometimes called Philippine, Philibert, Perrotet) and *Morus alba* have all been in favor, the latter having kept it finally. The *multicaulis* is considered as a variety of *M. nigra*, and has two sub-varieties. It gives the earliest leaf in spring, but its leaves are too aqueous to be of the best for sericulture.

It is my impression that we *must not* look to following any established or fixed rule in planting merely on the experience of European rearers; the kinds of Mulberry *they* have decided suited *their* climate, soils and seasons the best.

From what information I have been able to gather, there seems no hard and fast rule to go by, and we must look to experience under *our own* conditions, of climate, soils and seasons, and the preference shown by the worms, to point out to us our best variety or varieties for planting to suit our conditions. One thing is quite evident, and that is what suits one silk-rearing locality will not always suit another, and this endorses my opinion that, as we have hitherto had no scientific experience of sericulture in Upper India, leaving out Bengal, we must act on our own judgment, and by carefully working out statistics, learn what suits our circumstances the best. Even what may be best for the Gurdaspur District of the Punjab may not be the best for Dehra Dûn, and indeed from my present meagre local information I am led to understand that such difference between the two places does exist in the matter of suitable Mulberry trees.

To assist you in coming to a conclusion for yourselves as to the best kinds to plant, after you have had some experience of different varieties, the following are the points to decide you in favor of a particular kind of Mulberry; and if you find a variety giving you all these characteristics of a suitable tree, you may have confidence in planting that variety. I cannot do better, I think, than give you a translation of a chapter from Count Dandolo's great work on silk-worms, as being one of the very best authorities:—

"Notwithstanding what authors have been able to say at different times, it is now demonstrated that the only leaf which is suitable to the silk-worm* is that of the White Mulberry.

* In Europe he must mean, as in Japan they only use *M. nigra*.

"The first silk-worms which were reared in Europe were nourished with the leaf of the Black Mulberry, the only kind it appears which was cultivated then, notwithstanding that it was known the White was being cultivated* in Greece.

"However, it was not long before the cultivation of this latter variety was introduced in all the temperate regions of Europe.

"This Mulberry presented three advantages over the Black; firstly, that of being able to use the leaf sooner, and consequently avoid the feeding of the silk-worms being prolonged too far into the hot season; in the second place, that of giving much more leaf in less time; lastly, the quality of the leaf produced the quality of silk most approved of by the manufacturers, not that the quality of the silk depends solely upon that of the food, as it also depends upon the temperature in which the worm has been reared.

"As there exist several varieties of Mulberry, one may suppose that these differences should exercise a greater or less influence on the prosperity of the silk-worm.†

"In effect there are five different substances in the leaf of the Mulberry:—

"(1st.) The solid *Parenchyma* or fibrous substances; (2nd.) The colouring matter; (3rd.) Water; (4th.) Saccharine matter; (5th.) Resinous matter.

"The fibrous substance, colouring matter, and the water, save as much of the latter as serves the wants of the animal, are not, properly speaking, nutritives of the silk-worm.

"The saccharine matter is that which nourishes the insect, which makes it grow big, and which forms its animal substance.

"The resinous matter is that which separates itself gradually from the leaf, and which, attracted by the organism of the animal, accumulates in it, purifies itself, and fills insensibly the two reservoirs or silk-sacks which form an integral part of the silk-worm.

"According to the diverse proportions of the elements which constitute the leaf, there results that cases may present themselves in which a larger weight of leaf may prove less profitable to the silk-worm, as much owing to the want of nourishment as to the want of silk-producing material. For example, the leaf of the Black Mulberry, hard, coarse, tenacious, which is still given to silk-worms in some of the warm countries of Europe, such as in diverse places in Greece, Spain, Sicily, &c., produces a silk very abundant, of which the thread is very beautiful, but *coarse*.

* The geographical error of not allowing Greece to be in Europe is of no consequence, and should not be allowed to prejudice opinion against Count Dandolo's information on his pet subject.

† And as there are several varieties of silk-worms, why should not each variety have its own quality of food? One does not feed all kinds of horses alike, or the same in different climates.—C. H. L.

"The leaf of the White Mulberry, when planted in high grounds, exposed to cold and dry wind, in light soils, gives generally an abundant crop of silk, strong, very pure, and of a beautiful quality.

"The leaf of this same Mulberry, planted in damp places, on flat lands, in fat rich soils, gives a little less silk, less beautiful and less pure.

"These are the most general differences; there are others relative to the topography of the country.

"The less the leaf contains of nutritive substance, the more the silk-worm must consume to arrive at its development.

"It results from this that the silk-worm which consumes a large quantity of innutritious leaf, must be more fatigued and more in danger of falling ill than the one which eats less leaf, but of a more nutritious kind.

"As much may be said of the leaf which, although having nutritive parts, contains little resinous substance. In this case, the silk-worm could nourish itself well and become large, and at the same time not produce a full "fleshy" cocoon well covered with silk, and strong, that is to say proportioned to the weight of the worm, which happens sometimes owing to bad seasons.

"Notwithstanding all this, my experience proves that in a last analysis, all things being equal otherwise, the qualities of the lands produce a really very small difference on the quality of the leaf. That which will be always true, is that the cause which influences most the fineness of the silk is the degree of temperature in which the silk-worm is reared. I have already said it above, and I shall demonstrate it in the latter part of this work.

"Not only must you note the difference in quality which there is, in general, between the leaf of Mulberry trees placed in lands of different nature, and plucked in different seasons, but also the difference which you find between the leaves of different kinds of Mulberry trees planted on the *same site*. I have found, for example, that with equal weights of leaf, the leaf coming from the large-leaved Mulberry was a little less nutritious.

"I have observed that, after that one, comes the Mulberry which has large enough leaves, plump, and of a dark green colour. When these Mulberry trees are not exposed to a dry air and in light soils, they become very well covered with leaf, but they have not much material for making silk. It seems that nature finds it easier to produce a leaf which abounds in nutritive substance rather than in a resinous or silk-making substance.

"I find that the best leaf of the Mulberry, no matter of what kind, is that which is called "double"; it is small, little, succulent, of a dark green, shiny, and contains but little water,

which is easy enough to find out by drying it: the tree, to commence with, furnishes a large quantity.

"Generally the rearer is fond of those kinds of Mulberry trees which give the heaviest leaves, or the largest, without thinking that it is neither the water nor the fibrous tissue of the leaf which nourishes the silk-worm and renders the cocoons weighty, but in reality the substances I have named above instead. Here we must remember another observation of fact: it is under equal conditions the old Mulberry trees produce always a better leaf than the young trees. Much better indeed, as the trees become old, of whatever kind they may be, their leaves becoming always smaller and smaller, they improve so much that they finish by becoming all of one single quality.

"Up to now I have heard talk of the leaves of grafted Mulberry trees. The leaf of the naturally grown Mulberry is that which, in equal weight, and under the same circumstances, contains always a much larger quantity of nutritive substance and of silk-forming material.

"This leaf, in considerably *less* quantity than that of the grafted Mulberry, gives nevertheless better results. I do not know that any one, up to the present time, has made an exact comparison on a large scale on this important point.

"Another comparison which should fix the attention of Mulberry-cultivating proprietors, is that the grafted Mulberry, especially when old, produces a much larger quantity of White Mulberries than the natural-grown one."

"This fruit which, in general, the worm doesn't eat, forms none the less a portion of the weight of the leaf which the producer buys or sells. Notwithstanding this there are strong reasons† for preventing the general use of the natural grown leaf, *i.e.*, from trees not grafted.

"The worst leaf obtainable from the Mulberry, and one that is always disastrous to the silk-worm, is that which is covered with manna, an evil state which comes from sickness or an excess of health in the tree‡. I should never advise any one giving such leaf, except in case of paucity of supply; and then it should be well washed and dried with care§

"Leaves marked with rust do no harm to the worm. But it has the serious inconvenience of increasing greatly the refuse on the rearing-shelves. A large number of Mulberry trees can be seen attacked by this disease, particularly when they are in damp lands or in ill-ventilated places. The worm eats this leaf as well as that which is healthy; the only difference is, that it only chews the healthy part, avoiding carefully that which is "rusty." Those who have no other quality of leaf are

* As usual of course, as the nutritive power decreases, the reproductive "instinct" increases.

† These reasons are not of weight for India.

‡ Might not this come from the deposit of some insect?

obliged to give it in larger quantity, in order that the worms should not fatigue themselves in seeking their food. These insects would suffer if they were given leaf damped by rain

or dew to eat. Whatever may be the leaf that is given to the silk-worms, the greatest care should be taken to prevent heating, or fermentation,

Leaves can be easily dried by being spread on withering changes on Tea plantations, say 3 inches thick, and turned over every half hour, care being taken not to bruise the leaves and not to allow either withering, heating, or fermentation to begin; every effort should be used to preserve them as fresh as possible.

either in the plucking, or in the storing of it, before giving it to the worms.

"A high degree of fermentation changes for the worse, more or less, the nutritive substance of the leaf, which then becomes less nourishing. The leaf should not be left for long pressed in the baskets or cloths in which it is carried in from the plucking.

"Leaves are easily preserved two or three days in cool places, if they are a little moist and protected from the air, as in cellars, godowns, ground floors of bungalows, &c., provided they are not too stacked, and are turned from time to time. They must be prevented from losing their freshness owing to too much dryness in the place where they are kept, or by too much air; they rot also from too much damp and from being too stacked. It is very advantageous to have a suitable place to preserve the leaf two days, and even three in case of necessity."

In selecting your varieties of Mulberry, look out for the following conditions:—the produce of leaves; the produce of silk from a given quantity of leaves; the facility and rapidity obtainable in plucking the leaves; the power they have of retaining their freshness for more or less time. The nourishing and silk-producing qualities are of course evident by comparing the produce of silk from given quantities of leaves, as explained already. Look out for the varieties preferred by the worms themselves, as they show marked preference for certain kinds, and this may show different results in different soils, lay of lands and climates. Take care, however, that the age of the leaf given is consistent with the age of the worm to which it is given, or your conclusions will be based on false data. In this, as throughout the whole process of sericulture, treat the worms as though they have habits which nature has intended for them, and don't try to change the course of nature by trying to change these habits in any way. Find out their natural habits, and try and facilitate their work of making silk for you, by giving them as little *other* and *useless* work to do as possible, hence the desirability of giving them the best leaf obtainable.

Mark the time of year each variety of Mulberry comes into leaf, and always have a small proportion of early ones to begin on, and thus enable you to commence rearing as soon as danger from frost to the leaves is passed, and so avoid carrying the rearing on into the hot weather.

From a French Work I extract the following;—"The Mulberry grows in all soils, but its vegetation is more or less vigorous, and its leaf is more or less good, in each. It only refuses to grow in marshy lands, too calcareous, too superficial—and consequently too dry. It allows the use of arid, pebbly slopes (not of course situated on continuous rock). Its produce there is not abundant but of excellent quality. In rich, fresh deep soils its leaf is too watery.

"It is multiplied by sowing seed, by budding, by layers, and by cuttings.

"By the first means the most vigorous plants are obtained, the most durable, and those that resist drought the best.

"Budding gives trees more productive in leaf and of a more rapid growth.

"Layers produce a more certain success than budding, but a sufficiently large quantity cannot be obtained from the same area.

"Lastly, cuttings, less prompt and less sure than seed-sowing or budding seldom succeed save with the varieties *multicaulis* (Philippine) Hybrid and *Lhou*; they are chiefly used to obtain 'dwarf' or 'middle-sized' trees.

"'Dwarf' trees and 'middle-sized' trees refer in French to systems of cultivating the Mulberry, *e.g.*, they have 'full-sized', 'middle-sized,' 'dwarfs,' and 'hedges,' representing each a different system of planting and of cultivation.

PLUCKING.

On the method of plucking I translate the following:—

"Plucking commences in the morning, after the dew has disappeared, and it should be given up at night as soon as the mist falls, and should not go on during rain.

"For trees of any size ladders should be used. The plucker furnished with a bag or sack attached to his waist and kept open by a piece of circular wood, or wooden-hoop of an old cask, mounts his ladder, seizes successively each shoot by its base, and *slides his hand rapidly from below upwards, detaches thus without trouble all the leaves which he then places in his sack. When this receptacle is filled, it is emptied into a cloth placed in the shade or covered with another cloth. When this in turn is filled it is tied up by knotting the four corners and carried *at once* to the rearing-shed in order not to allow the leaf to wither."

* The Japanese do not believe in this, as being bad for the trees. See translation later on.

PRUNING.

On the manner of pruning I translate the following :—

"As soon as the crop is over, all the shoots, which gave the leaves that have been plucked off, are pruned just above the last two buds nearest the base; this is the *Summer-pruning*.

"The tree brought up or reared with 12 to 25 branches always retains its primitive goblet shape. In the following spring (in India this should probably be about the end of December) all the poor looking twigs are suppressed, and those too near each other thinned out; all the dry twigs are taken off, and the leaves that have come on the shoots, two and two, which have grown since the Summer-pruning."

This, of course, is purely a Utilitarian process.

I translate the following account of the Japanese treatment of Mulberry trees from a "Report on Sericultural Studies" made by an Italian Mission in the interior of Japan, dated Yokohama, 1st July 1869, and quoted by that great authority on the Diseases of Silk-worms. M. L. Pasteur, F.R.S., and member of the Institute of France, from the *Revue Universelle de Sericulture*; September 1869 :—

"The *Morus alba*, or White Mulberry, does not exist in Japan, where they only know the Mulberry tree bearing* black fruit, with a leaf sometimes round sometimes indented.

"It is found everywhere, the length of the lanes, on the banks of canals and in masses clumped in the middle of cultivated fields. It seldom grows higher than 9 ft. 9 in.; the Japanese cultivate it ordinarily in thickets, and they cut off the branches at the level of the ground, covering then the roots and manuring them, either with human manure or with the sweepings of the rearing-sheds dried first in the sun. The same manner is used for trees allowed to grow to 'Full-size,' and in that case they spread it on the land round the trunks of the trees.

"The reproduction of the trees is not obtained in Japan from seed but by suckers. In spring they cut down to ground level, a plant about 8 years old at least, from the lower trunk, and roots recovered with earth spring up the new shoots. These again, in the following autumn, are cut at the trunk and serve to form new plants which are manured with human night soil."

From the work of a Swiss gentleman whom I knew years ago when in Japan, when he was engaged in business there in the purchase of silk, I translate the following, which may be taken for what it is worth, as coming from a so-to-speak amateur source :—"The cultivation of the Mulberry (in Japan) is rare

* Not that this is a sign of its belonging to *M. nigra*.

in the neighbourhood of the sea, whether it be that the Japanese think such situation unfavorable to the tree, or perhaps owing to the conditions of the soil.

"A soil somewhat sandy, mixed with earth and slightly damp, is regarded as very appropriate to this culture, such as the banks of streams, and places where water runs easily. The Mulberry in Japan thrives best in the 'dwarf' state; the head of the trunk hardly rises a foot above the level of the ground, and the branches reach about three or four feet only in height. It is said that by this system the leaves become more tender and more suitable to the health of the worms. Barely they allow a tree to arrive at its full growth, however it may often be seen about five feet high. They carefully remove surplus branches which might make the foliage too dense; and they carefully prevent any settlement of birds or insects in the trees. When the trees have reached forty years of age they are torn up and replaced by young ones.

"The propagation of the Mulberry trees is carried on in the three following ways: By *Seed sowing* they carefully wash the fruit, mix them with wood ashes, and plant the mixture; by *plants* in utilizing to this end the young branches* and proceeding as in Europe. These two ways are but seldom employed; the most extensively adopted is the propagation by *layers* (Marcottes). This is done towards the end of June, by bringing down the branches of a dwarf tree, and partly covering them with earth to make them take root. Ten months afterwards the plants thus obtained are transplanted into a site, manured and prepared for their reception, where they remain temporarily for one year, and from whence they pass to their final destination. A year after this transplanting they commence to use the leaves for feeding silk-worms.

"The manuring of the trees takes place several times throughout the year.

"Budding is nowhere employed so far as we could find out, though it is spoken of in certain old Japanese books. To feed the worms they cut the branches so as to leave a sharp clean end, the leaves only being plucked off at the house.

"The Japanese believe that it injures the tree to pluck the leaves direct from the tree on account of the wounds it causes to the stem.

"All rearers do not own their own leaves. Many of them buy their leaves at the special market for this business. The sellers bring their leaves to the village in the morning, and offer them down the principal street, in the shade of the houses. Prices vary considerably according to the quality and state of the trees; sometimes 4 *bous*, other years 12, 16, and even more per horse load of 200 catties. (The *bou* is equivalent to about

* *Suckers.*

9 annas; the catty to $1\frac{1}{2}$ English pound weight.) Plantations of Mulberry trees, properly speaking, are only found near Yonésawa and Onéda; elsewhere they are usually in groups, more or less extensive, along hill-sides and streams, so that they give an idea of being quite a second rate cultivation."

French statistics relating to Mulberry cultivation.

The following few statistics may prove interesting to some as showing how important the dimensions of Mulberry cultivation may become to a country suited to it by nature.

In the Cévennes near Vigan (Gard) France, some Mulberry trees of "full-size" kind planted about 23 feet apart in quin-cunx, produced the following yield of leaf each year:—

at 3 years old $3\frac{1}{2}$ kilos; at 13 years old $75\frac{1}{10}$ kilos.

" 4	"	$11\frac{3}{5}$	"	" 14	"	$77\frac{3}{5}$	"
" 5	"	$17\frac{9}{10}$	"	" 15	"	$84\frac{1}{2}$	"
" 6	"	$25\frac{7}{10}$	"	" 16	"	$88\frac{1}{2}$	"
" 7	"	$32\frac{7}{10}$	"	" 17	"	$91\frac{1}{2}$	"
" 8	"	$42\frac{3}{5}$	"	" 18	"	$94\frac{1}{2}$	"
" 9	"	$48\frac{3}{10}$	"	" 19	"	$96\frac{1}{2}$	"
" 10	"	$52\frac{1}{2}$	"	" 20	"	$98\frac{1}{2}$	"
" 11	"	$64\frac{2}{5}$	"	" 21	"	99	"
" 12	"	69	"	" 22	"	100	"

say averaging $57\frac{1}{2}$ kilos per annum each tree, or roughly taking 1 kilo, to equal 1 seer 2 chittacks, say 65 seers per annum each tree; taking from this 15 seers for loss and waste, leaves 50 seers or at above distance apart $102\frac{1}{2}$ maunds of leaf per acre. One chittack of eggs or "seed" should require 40 good trees of 50 seers each tree, or say two chittacks of "seed" would require an acre of such trees, planted as above, 23 feet apart. Two chittacks of "seed" should produce $3\frac{1}{2}$ maunds of green cocoons worth Rs. 30 per maund, if good, or value of one acre's produce planted as above, Rs. 93-12-0. But this planting at such a wide distance is to allow of cultivation of other crops between the trees, and out here where the land would probably be given up entirely to Mulberry cultivation, on the spots set apart for it, 12 feet by 12 feet, 13 feet by 13 feet, or at outside 15 feet by 15 feet, would probably be the distances found amply sufficient, as large trees are undesirable owing to the difficulty of plucking.

If then the acre be planted about 12 feet by 12 feet, one acre should produce about 12 maunds of green cocoons, value Rs. 30 per maund, if good, or say total value of one acre's produce would be Rs. 360 *per acre*! What other cultivation can offer such a return for only two months' work in the whole year? off land unfit for almost any other crop! Of course there are risks in this as in every other pursuit depending upon circumstances over which man has no control.

In this climate, however, and with such suitable conditions as there are to hand, the very home of the Mulberry (unlike France to which it was exotic) and with freshly imported *healthy* "seed," the risks of sericulture, apart from the faults of carelessness and inattention, should be reduced to the minimum.

The following figures illustrating the huge proportions the industry attained in France before its collapse, show how valuable it is to a country, and what temptations it must have offered ever to reach such figures. Especially remarkable too when it is remembered that only a portion of France, not one-half I believe, is suited to the industry from climatic causes, &c.

In France then, in 1852 there were 69,687 acres under Mulberry trees.

In 1862, i.e., 10 years later only, it was nearly double, viz., 121,542 acres!

In 1852 they counted 17,762,906 isolated Mulberry trees, and over 7,264,000 yards of Mulberry hedges for silk-worm feeding, or say over 4,127 miles of Mulberry hedges.

In 1852 the amount of leaf used by rearers was about 5,700,850 maunds, or say roughly 456,068,000 lbs., or over 203,600 tons, representing in value Frs. 33,506,018, or say roughly at 2 frs. per rupee, Rs. 16,754,509 for *leaf* alone—a sum which has gradually been decreasing year by year with the ruin that has fallen upon sericulture in France, from disease amongst the worms, the effects of the war and other causes.

This fabulous sum to be thrown direct into the hands of peasant proprietors, and their labourers, is surely enough to tempt any Government lucky enough to own suitable land and climate, to exert every possible effort to almost force attention to such a promising industry, the more especially as it is now hardly a case of competing with France, since the industry is almost destroyed there. It is merely a case of replacing here and under much more favorable auspices, when cheapness of labour and suitability of climate are taken into account. And this part of India, unlike Bengal, can, I firmly believe, produce silk of equal and possibly superior quality to the average best qualities produced in France, at a much less cost in every way.

Bengal silk being very inferior in reputation has, of course, suffered in the "hard times" of late years, but with the quality of cocoons obtainable in the north west of India, in the Sub-Himalayan country, at the cost they should be produced at, there should always be ample margin for the play of markets without fear of loss, once the trees are fairly into bearing, and planted with a view to economy in carriage of leaf—a most important item for consideration, and one I cannot lay too much stress upon.

Plantations *must* be near the rearing-sheds to ensure economical working, and freshness in the leaf supplied to the worms. To Europeans therefore desirous of taking up the experiment, I would offer the advice that they leave room for their rearing-sheds on their Mulberry plantations, and ask them to bear in mind that many small rearing-sheds are better than one large one, as large masses of worms, when collected in one place, have been found to run greater risk from disease than smaller collections.

Leave the sites for the houses running North and South, and the door end to be at the North, so that the sun's rays can never enter by the door and scorch the worms. The front of the house should face the East.

Long before the trees are ready, however, I hope to be able to offer Part II of this little pamphlet to those whom it may interest, and which will treat, on the best arrangements, for rearing-sheds and on the feeding of the worms.

Before saying, *au revoir*, I would mention that I have taken no notice of the Bengal system as from climate, &c., I trust rearers here will be able to employ a very different class of worm, and follow Japanese or European systems rather than that of Bengal, if they do not have to strike out a line for themselves, as this will be the earliest crop in the world of the class of worm I hope they will succeed with.

In concluding Part I of this pamphlet I would point out as an encouragement to Europeans thinking, yet hesitating, about attempting Mulberry planting with a view to sericulture in proper time, that Messrs. Lister and Co., who have taken this matter up with such energy, good will and hope for the future, are ready to supply the want that has hitherto acted as a serious check on the advance of this industry in the North West of India (I include the Punjab and Kangra Valley) *viz.*, that of a local market.

There need be no fear of there ever being a case of production exceeding the demand of the said market, as Messrs. Lister & Co. have their agents in every silk-growing country in the world to assist in collecting sufficient for their vast requirements, and enterprise here will never, practically speaking, be able to produce collectively more than Messrs. Lister and Co. can take with pleasure, and at rates that will pay the rearers handsomely, always provided, they in return make a business of producing *good* cocoons, and do not run counter to their own interest by producing none but inferior ones. In this Messrs. Lister & Co. only expect what the purchasers of teas now look for, *viz.*, the best possible general average, and in return can offer cash in full value *on the spot*.

Examination of the Annual Rings of Chir :

Being an Extract from a Report on the Tons Chir Forests.

By A. SMYTHIES, Assistant Conservator.

Fellings of Chir had been made along the Tons in 1874-75, and advantage was taken of this circumstance to examine the stumps that were left, and to count the annual rings. Many stumps had been burnt, and others had decayed, but it was found possible to count the rings on 153 stumps, situated partly on Karoli Flat, partly on adjoining hill sides. On 64 stumps the rings were counted along two radii, a short and a long one, and the mean result was taken; on the remaining 89 it was found practicable to count the rings along one radius only, the one chosen being as far as possible a mean one. The counting was carried out by a Patrol of the Deoban Forests, named Jaman Singh. This man was employed for three months on similar work in 1878, near Deoban, and in both cases his results were constantly tested by me, and were found to be most satisfactory. I have no hesitation, therefore, in adopting his figures as substantially correct. It would have been quite impossible for either Mr. Murray or myself to undertake this counting within the allotted time, as it required 28 days to complete.

With these remarks I now proceed to analyse the results, of which full details are given in Appendix B.

The radii along which the rings were counted were 27·5, 5·5, 8·25, 11, 13, 15, and 18 inches in length respectively. The first four radii correspond to girths of 1 foot 6 inches, 3 feet, 4 feet 6 inches, and 6 feet, allowing something for the bark (see letter in *Indian Forester*, Vol. IV, No. II, p. 192). The other three are convenient lengths without corresponding to any particular girth classes. At the same time the thickness of the bark of each stump was measured, and it was found that the mean was rather less than one inch, but in many cases the thickness had been diminished by fire and other accidents. If we allow one inch as the average thickness, then the real girths, outside the bark, corresponding to the above radii, would have been 1 foot 11½ inches, 3 feet 4·8 inches, 4 feet 10½ inches, and 6 feet 3¾ inches. That is allowing the same thickness of bark for a pole of the 1½ foot class, as for a tree of the 6-foot girth class, which is not fair; while one is too great, the other is too small, as the bark of a living tree 6 feet in girth would be about 1½ inches thick instead of 1 inch.

It will be observed from the figures here given that many of these stumps belonged to trees which were either suppressed or had suffered such injury that their growth was severely checked. Nos. 12 to 19 are an instance of this, and it becomes a question for consideration in working out a mean result as to what we are to exclude as suppressed trees.

The group above mentioned will furnish us with good data to go upon; they all stopped short in their growth at comparatively small dimensions, or in other words, they shew small girths at advanced ages; they vary in age from 139 to 199 years, and in diameter from 23 to $27\frac{1}{2}$ inches. Comparing them with other trees, it is obvious that they were suppressed before they attained a girth of 6 feet, and for the purposes of the present analysis, we shall take as a suppressed tree, any tree which required 130 years or more to reach a girth of 6 feet. On looking over the list, it will be found that all trees which come into this category required a great number of years to attain small dimensions, and that the average number of rings per inch is as a rule over 12.

It is a matter for consideration whether it would have been better to have taken some other age as the limit, 120 years, for example, Nos. 46, 85, 139, 145, 146 and 149 shew on an average over 12 rings per inch and attained a girth of 6 feet between 120 and 130 years of age. There are, however, many trees which shew over 12 rings per inch, taking an average for the whole life of the tree, which nevertheless attained a girth of 6 feet within 120 years, including several which reached this girth within even 100 years. Thus we cannot include among suppressed trees *all* which shew an average of 12 rings and more per inch of radius. Nos. 1, 8, 11, 24, 30, 35, not to mention others, amply prove this. The number of stumps examined is too few to admit of a general rule being laid down on the subject, and it must be left for further experience to decide this question. For the present, however, we have adopted the limit of 130 years, as it seems to apply pretty generally, and we have worked out the mean results, both including and excluding suppressed trees as defined above in each of the three following cases:—

- (1). Taking all the trees together.
- (2). Taking the 39 trees on Karoli Flat.
- (3). Taking the 114 trees on the hill side.

(1).—*Including suppressed trees. 153 stumps.*

Length of radius ...	2.57	5.5	8.25	11.	13.	15.
No. of rings ..	17	37	66	104 (1)	126 (2)	152 (3)

(1) average of 149. (2) average of 114. (3) average of 75.

(1).—*Excluding suppressed trees. 113 stumps.*

Length of radius ...	2.75	5.5	8.25	11.	13.	15.
No. of rings...	17	34	56	86 (1)	118 (2)	151 (3)

(1) average of 112. (2) average of 101. (3) average of 74.

(2).—KAROLI FLAT. *Including suppressed trees. 39 stumps.*

Length of radius ...	2.75	5.5	8.25	11.	13	15.
No. of rings ...	12	30	62	105 (1)	122 (2)	154 (3)

(1) average of 37. (2) average of 26. (3) average of 19.

(2).—KAROLI FLAT. *Excluding suppressed trees. 24 stumps.*

Length of radius ...	2.75	5.5	8.25	11.	13.	15.
No. of rings ...	12	26	48	83	114 (1)	151 (2)

(1) average of 23. (2) average of 18.

(3).—HILL SIDES. *Including suppressed trees. 114 stumps.*

Length of radius ...	2.75	5.5	8.25	11.	13.	15.
No. of rings ...	19	40	67	103 (1)	127 (2)	151 (3)

(1) average of 112. (2) average of 88. (3) average of 58.

(3).—HILL SIDES. *Excluding suppressed trees. 89 stumps.*

Length of radius ...	2.75	5.5	8.25	11.	13.	15.
No. of rings ...	18	36	58	88 (1)	118 (2)	151 (3)

(1) average of 88. (2) average of 78. (3) average of 56.

It was not necessary to give the figures for Karoli Flat and the hill sides separately, but they are interesting, as they tend to prove that the growth of Chir is slower on the hill sides than on level ground during the first half of its life. The important point, however, was to find at what age Chir reaches a girth of 6 feet, and this, of course, depends on what age we take as the limit of suppressed trees. Including all trees, we have 104 years as the age at which the tree attains 6 feet in girth, and excluding suppressed trees, we find this girth at the age of 86 years. Carrying the analysis further, we find that 2 trees attained a girth of 6 feet between the ages of 40 and 50 years, 7 trees between 50 and 60, 17 trees between 60 and 70, 18 trees between 70 and 80, 22 trees between 80 and 90, 16 trees between 90 and 100, while the remaining 71 trees, or very nearly half the total number, required 100 years or more to reach this girth. It will be interesting to compare these figures with those obtained in the case of *Abies Webbiana*. We find that of 97 Morinda trees examined in the Deoban Forests, a girth of 6 feet was attained by 8 trees between 40 and 50 years, by 9 trees between 50 and 60, by 17 trees between 60 and 70, by 13 trees between 70 and 80, by 17 trees between 80 and 90, by 11 trees between

90 and 100, and by 22 trees at the age of 100 years or more. These results, as far as they go, prove that the growth of Chir is somewhat slower than the growth of Morinda.

Out of the 153 chir stumps examined, 58 belonged to trees which attained an age of 200 years and over, the longest lived being No. 50 with 258 years, and a mean rate of growth of 13 rings per inch of radius.

Examination of the annual rings of Pinus longifolia in the Tons Chir Forests. January and February 1879.
39 Stumps examined on Karoli Flat.

No. of Stump.	Rings counted on a radius of							No. of rings up to end of longest radius.	Length in inches of longest radius.	No. of rings per inch.
	2-75"	5-5"	8-25"	11-0"	13"	15"	18"			
1	11	26	50	86	148	180	...	.....	.....	12
2	13	34	79	164	190	...	...	.....	.....	14.6
3	9	24	49	100	157	230	...	.....	.....	15.3
4	10	23	34	64	88	115	206	248	20½	11.4
5	11	24	31	49	57	98	...	160	19½	8.2
6	11	28	53	88	102	141	...	.....	.....	9.4
7	13	27	44	73	121	...	...	150	13½	11.3
8	10	27	50	80	120	179	...	208	16½	12
9	8	20	30	51	69	97	148	.....	.....	8.2
10	15	34	66	79	107	138	150	.....	.....	10.6
11	13	26	50	79	108	138	...	196	16	12.2
12	14	38	88	120	161	...	...	171	13½	12.4
13	11	32	76	174	...	...	...	191	11½	15.3
14	13	29	72	155	...	...	...	169	11½	14
15	15	47	114	162	...	...	...	199	12½	16.1
16	12	28	58	149	...	...	...	155	11½	13.5
17	12	34	72	135	...	...	...	190	13½	12.2
18	16	35	86	139	...	...	...	139	11½	12
19	11	22	60	139	...	...	...	182	12½	12.6
20	19	43	85	...	...	...	...	110	9½	11.8
21	14	45	97	...	...	...	...	132	11½	11.7
22	11	27	57	94	127	169	...	212	16½	12.9
23	11	34	76	148	...	...	...	181	13½	13.4
24	13	31	53	86	116	164	...	225	17	13.2
25	13	39	95	137	...	...	...	150	13	12.5
26	12	32	94	151	...	...	...	.....	.....	13.7
27	11	22	38	66	93	138	...	182	17	10.7
28	12	27	53	83	124	168	...	.....	.....	11.2
29	13	27	54	107	154	...	...	170	13½	12.6
30	13	24	44	81	129	...	...	176	14½	12.1
31	12	30	66	120	...	...	...	146	11½	12.6
32	10	25	50	77	108	148	...	182	17½	10.2
33	11	21	31	57	84	122	...	189	13	8.3
34	14	30	53	82	116	157	...	177	16	11
35	13	33	55	87	119	166	...	232	16½	14
36	11	23	41	77	111	...	...	197	16	8.5
37	10	23	48	91	127	176	...	223	13	11.6
38	14	41	95	142	171	203	...	213	16	13.3
39	14	29	51	106	163	...	...	.....	.....	12.5

Stumps on hill side within half a mile of the Tens.

No. of Stump.	Rings counted on a radius of							No. of rings up to end of longest radius.	Length in inches of longest radius.	No. of rings per inch.
	3-78"	5-6"	8-28"	11"	13"	15"	16"			
40	10	22	46	92	135	...	...	176	14½	12.1
41	14	27	62	112	178	...	...	182	13½	13.7
42	17	51	99	147	177	...	...	...	...	13.6
43	10	25	40	63	86	160	...	189	16½	12.2
44	24	43	63	90	119	152	215	254	19½	13.
45	24	37	53	73	95	125	214	...	...	11.9
46	27	48	78	121	179	...	...	218	14½	13.
47	21	39	59	83	105	133	193	224	19½	11.4
48	28	63	101	157	199	...	...	232	13½	17.2
49	21	42	72	114	161	201	227	237	18½	12.8
50	16	41	83	118	143	184	241	258	18½	13.7
51	23	51	81	116	164	221	...	...	...	14.7
52	12	24	38	70	125	206	...	...	...	13.7
53	17	31	49	78	108	128	180	222	20½	10.8
54	18	36	56	89	138	193	...	198	15½	12.9
55	24	53	124	205	...	...	...	...	...	18.6
56	20	41	68	105	130	164	...	203	16½	12.1
57	32	40	61	85	114	162	...	178	15½	11.3
58	19	40	61	100	138	...	...	219	18½	13.
59	19	47	83	144	...	...	...	204	16	12.7
60	18	39	74	142	201	...	...	212	13½	15.7
61	14	30	45	69	106	180	...	215	15½	13.2
62	34	63	78	92	103	118	...	180	17½	9.2
63	21	42	67	97	126	148	190	...	...	10.6
64	17	32	49	75	121	180	...	...	...	12.
65	29	35	51	65	75	89	121	142	18½	7.6
66	22	45	66	102	132	190	...	196	16	12.2
67	21	32	45	62	98	...	...	184	17	10.8
68	15	30	48	76	101	149	...	169	15½	10.7
69	19	30	43	54	62	73	99	146	21	6.9
70	21	38	59	84	111	155	...	169	16½	12.
71	15	36	62	100	150	216	...	241	16	15.
72	17	32	45	59	80	118	...	145	16½	8.7
73	23	35	50	66	84	105	...	140	16½	8.3
74	18	34	48	67	85	107	170	...	...	9.4
75	15	34	55	89	113	...	...	157	16½	9.3
76	20	36	51	69	99	132	...	...	...	12.1
77	16	37	62	90	128	...	...	177	16½	10.8
78	17	32	47	65	84	106	143	162	19	8.9
79	17	32	50	82	119	...	...	174	17½	9.8
80	15	40	77	147	...	...	...	169	11½	13.8
81	17	39	61	82	95	108	143	164	19	8.1
82	24	35	61	94	148	...	...	201	17½	11.4
83	27	61	120	189	...	...	...	203	13	15.6
84	20	47	77	121	167	200	...	250	17½	14.
85	17	40	69	121	201	...	...	...	...	15.5
86	18	32	49	71	104	156	...	201	18	11.1
87	22	39	52	76	101	169	...	223	17	13.1
88	22	78	134	186	216	...	...	222	14	16.5
89	29	54	80	126	176	...	...	186	13½	13.7
90	17	44	90	127	160	186	...	201	15½	13.
91	18	39	68	113	...	...	...	164	11½	13.9

Stumps on hill side within half a mile of the Tons—(Contd.)

No. of Stump.	Rings counted on a radius of							No. of rings up to end of longest radius.	Length in inches of longest radius.	No. of rings per inch.
	2-75"	5-5"	8-25"	11"	13"	15"	18"			
92	15	30	51	91	149	...	...	214	14½	14.7
93	16	32	55	85	105	...	...	176	17	10.3
94	15	31	70	151	...	...	...	.....	.....	13.7
95	23	38	60	106	156	...	...	.....	.....	12.
96	16	32	53	94	138	...	...	171	14½	11.7
97	21	35	47	64	80	102	152	190	19	10.
98	15	27	38	60	91	...	...	156	16½	9.6
99	15	39	58	103	...	...	...	174	15	11.6
100	14	26	44	75	116	155	...	183	16	11.7
101	19	57	98	140	...	...	...	165	12	13.7
102	13	31	54	157	...	...	...	230	16½	13.7
103	26	58	102	176	...	...	...	221	11½	18.8
104	22	41	66	87	109	169	...	234	22	10.6
105	17	34	59	90	123	190	...	196	15½	12.6
106	16	51	86	140	208	...	...	.....	.....	16.
107	17	33	56	97	...	...	...	136	16½	8.2
108	19	47	73	106	...	...	...	124	12½	10.1
109	13	29	42	57	74	122	...	161	16	10.
110	13	22	30	43	57	74	130	159	19	8.3
111	14	25	39	69	...	...	...	139	14½	9.5
112	15	26	40	59	76	93	130	159	22½	7.1
113	23	46	73	111	...	...	...	162	15½	10.4
114	16	37	60	86	113	143	...	159	15½	10.
115	14	31	49	72	103	...	...	127	14½	8.7
116	15	34	58	94	...	...	...	128	12½	10.2
117	17	33	52	82	117	172	...	.....	.....	11.4
118	11	24	36	54	69	93	148	171	18½	9.1
119	14	30	49	72	92	...	...	135	16½	8.1
120	19	36	57	80	113	151	230	.....	.....	12.7
121	19	39	76	...	...	...	...	210	17	12.3
122	19	47	67	97	139	188	...	252	19	13.2
123	25	55	95	141	196	...	...	203	14	14.5
124	15	29	43	64	92	132	201	.....	.....	11.1
125	17	30	45	67	90	180	188	230	19½	11.6
126	15	40	79	141	182	...	...	189	13½	14.2
127	18	40	66	95	126	166	218	232	18½	12.5
128	16	49	93	152	203	...	...	.....	.....	15.6
129	14	30	52	91	127	...	...	133	13½	9.8
130	15	30	48	69	83	114	...	180	17½	10.2
131	24	59	98	135	164	...	...	209	16½	12.4
132	16	33	54	77	...	...	...	140	15	9.3
133	23	53	89	142	...	...	...	168	12½	13.4
134	28	74	123	174	...	...	...	198	12½	15.5
135	28	72	125	170	...	...	...	199	13½	14.7
136	35	87	153	201	...	...	...	242	14½	17.
137	21	52	129	...	...	...	...	234	14½	16.1
138	25	53	99	171	215	...	...	257	15½	16.3
139	22	42	74	120	162	208	...	252	17½	14.
140	19	42	65	100	139	204	...	230	18½	12.2
141	18	30	49	74	96	133	...	180	17	10.5
142	15	32	48	63	76	96	154	196	20	9.8
143	14	31	55	83	106	129	...	169	17½	9.5

Stumps on hill side within half a mile of the Tons—(Contd.)

No. of Stump.	Rings counted on a radius of							No. of rings up to end of longest radius.	Length in inches of longest radius.	No. of rings per inch.
	2-75'	5-5"	8-25"	11"	13"	15"	18"			
144	19	38	60	110	...	...	...	158	15½	10·1
145	23	45	75	122	163	...	...	175	12½	12·5
146	22	51	79	126	173	...	...	218	15	14·
147	16	31	50	75	121	190	...	210	15½	13·8
148	24	51	97	191	...	...	...	235	13½	17·4
149	26	57	86	123	170	...	...	193	15	12·8
150	27	70	133	165	...	...	...	232	19½	12·
151	18	37	63	128	...	...	...	215	13½	16·2
152	21	39	60	101	137	177	...	242	21	11·5
153	24	42	65	86	112	167	...	250	18	13·8

Experimental Consignments of Indian Woods in the London Market.

SPECIMENS of 21 different kinds of Indian woods from the Dehra Dún Division, chief among which were boxwood, Toon and *Thanella* (*Gardenia turgida*) have lately been sent home for experiment from the N. W. Provinces, and the following are the remarks made on them by the timber merchants, Messrs. Churchill and Sim:—

“Boxwood.—The specimen has been faced in the manner usual in preparing wood for engraving, and my opinion is, that this particular example proved to be equal to Boxwood from Turkey, in fact superior to much that is obtained from thence, and has the advantage of paleness of colour, which is a feature of much value.

“A log of East India Boxwood, of about 12 feet long, was sent me in a sound state, and had cost £7, but on being divided into three pieces, had rapidly developed several rents, and had become valueless.

“Turkey Boxwood is not free from such defects, but in the best specimens only one rent forms.

“I presume you are aware that engraving is effected on horizontal sections of the tree. For this purpose, sections are sawn slightly over one inch thick, which are then placed in racks, and kept in a regulated temperature for some years.

“A wood block, such as you see in the illustrated papers, is built up of selected pieces, about 3 inches by 2 inches, which are separately worked upon, and afterwards combined into one by special forms of bolts and nuts. These blocks, I may observe, are not ordinarily used in printing, the ultimate printing surface being obtained by means of the electrotpe.

"Most hard woods are denser on one side than the other, and in the special example of Boxwood, the subject of this letter, a portion about 3 by 2 inches would only be used for the best work, and the remainder applied to blocks of lesser value.

"The manufacturer of wood blocks is said to pay three times more than the ordinary current value for the wood he selects. There is at this time much complaint, both by manufacturers and engravers, of the scarcity of fine material. This is in part attributed to wood growing in certain Russian forests being withheld from sale.

"I think it probable that the rendering of the logs may be in some degree lessened by attention to the period of cutting. Upon the indifference in colonies to the time of felling some excellent observations have been made by Mr. More, Director of the Botanic Gardens at Sydney, which may almost be summed up in his own words: "It would appear that the best time to cut down trees, in order to secure the most enduring timber, is either immediately after the fall of the leaf of those that are deciduous, or *shortly after the seed has ripened into maturity in those that are of an evergreen character.*"

"No. 18 (*Gardenia turgida*) appears to be of good close-grained quality, and the specimen shows no indication of splitting. We think it would be found saleable as a substitute for cheap Boxwood, and should like to see a larger specimen of this wood, in order to have its value tested, and therefore recommend that a log of about 12 inches square and about 10 feet long be sent for this purpose.

"The most promising specimen is No. 11 (*Cedrela Toona*), of which we have a good opinion, and consider that it would prove saleable as a substitute for Mahogany; and if sent in well-squared (hewn and not sawn) logs, 15 inches and upwards square and 12 feet and upwards in length, it would probably command from 2s. 6d. to 3s. per foot cube; but a trial shipment of 10 to 12 logs as large, long, sound and straight as possible would be advisable before sending larger quantities."

The other woods sent were reported not to be of a character fit for the Cabinet trade, chiefly on account of their hardness and lack of any special merit. We are rather surprised, however, that Sain, Sandan, Mohwa, Sissu, Khair and Siris were not noticed, as we should have thought some of them might have been rather better reported on.

On some Woods and Wood products in common use in Japan.

From the Timber Trades Journal.

(Continued from Vol. V., p. 467).

Building Woods.—Resinous woods and bamboos are the woods most commonly used in Japanese structures. Pines (*P. Massoniana*, *densiflora*, *parviflora*, *Koraiensis*), firs (*Abies firma*, *tsuga*, *aleutica*, *Veitchii*, *polita*, *Isoensis*), retinosporas (*R. obtusa*, *pisifera*), *Cryptomeria Japonica*, *Larix leptolepis*, *Thuja dolabrata*, &c., abound on light soils. On heavier soils oaks, chestnuts, and other foliage trees are plentiful. Dr. Savatier has enumerated eighteen deciduous and evergreen species of oak found in Japan, besides four which he regards as mere varieties and five others as yet indeterminate. But the difficulties of transit, and the need of light structures in a country where earthquakes are so common as in Japan, have caused heavier woods to be restricted to specific objects, and preference to be given to resinous woods, even for such ineligible purposes as bridge building and railway sleepers. And of all resinous woods, hinoki, the wood of *Retinospora obtusa* enjoys the highest repute. The tree, which grows with amazing rapidity and vigour, is held sacred in the Shinto religion. In most of the temples, and in the palace of the Mikado, hinoki has been used almost exclusively both for the structure and the furniture. It is generally employed unvarnished. It gives a beautifully white even grain under the plane, and is said to withstand damp perfectly. It is soft enough to take the impression of the finger nail. Sawara, the wood of *Retinospora pisifera*, is used for like purposes, but is less esteemed.

The costliest roofs are formed of frames of hinoki, overlaid with thin strips of the same wood, each strip being eight inches long, 2 inches broad and two-tenths inches thick, and very carefully planed, laid side by side with their long sides at right angles to the eaves. They are treenailed to the laths beneath, each course overlapping the one next below it some six inches or more. A very high pitch is needed, and much material and labour are requisite, but the arrangement lends itself to the production of the most fanciful and complex curves. With a sufficient pitch these roofs are perfectly water-tight, and some are said to be over a hundred years old. The residences of the high officials and many Buddhist temples are laid with flat tiles set in cement on a surface formed of yane-ita or small laths, one-tenth inch in thickness, laid close together. The best of these yane-ita are made of retinospora; the worst of split green bamboo. Poorer dwellings are roofed with split bamboos laid ridge and furrow, like tiles, or with wooden shingles fastened to the rafters with bamboo treenails, or with bark, thatch, or paper. Gutters are formed with split bamboos.

Woods for Paper-making.—The coarsest papers are manufactured from the bark of *Edgeworthia papyrifera*, called Mil-soumata (or three-pronged fork), owing to the shoots appearing symmetrically in triplets. It forms a shrub growing about five feet high, and is cut down level with the ground year after year until it gives a sufficiently bushy head for stripping. Good paper is also made from Kozou, i.e., the bark of the paper-mulberry (*Broussonetia papyrifera*), which is cultivated for paper-making all over Japan. The plantations are said to average about a ton of bark to the English acre annually, which is, however, believed to be a very exaggerated estimate. The fineness and toughness of this paper allow it to be used for a variety of purposes unknown in Europe, such as substitutes for window glass, in which ornamental effects may be produced by using papers of different degrees of transparency, bandages for wounds, pocket handkerchiefs, twine and thread of all sizes, &c., &c. By passing the wove-mould a second time through the pulp so as to cross the grain, a stouter paper is obtained, used for covering umbrellas, trunks, &c. The magnificent *leather paper*, with or without embossed patterns, the manufacture of which is still a profound secret, is made from Kozou. A sort of tissue paper of great strength and marvellous fineness and softness of texture, weighing only half a pound avoirdupois per 100 sheets of 19 inches by 14 inches, is made from the bark of a shrub called gampi, which appears to be *Lychnis grandiflora*, and has a fine-grained mucilaginous bark. Another paper of extraordinary strength, which figured in the last Paris Exhibition, is manufactured from some unknown material. For common papers, rice-straw, young shoots of bamboos and other substances are mixed with the pulp. Japanese papers are not generally sized, but when done it is with a mucilage obtained from the bark of a shrub called ouri (*Marlea japonica*?). Sized papers are coming into more common use, being better adapted than others to printing in European type. In the mountains, shavings of retinospora are used as a substitute for paper.

Lacquers and Varnishes.—These are all made with a resinous base extracted from ourouchi (*Rhus vernicifera*), which is not to be confounded with the so-called Japanese varnish of Europe. There are eight kinds of lacquers, some colourless, others coloured, each made by separate makers and by processes which yet remain secret. The resisting powers of these lacquers appear to increase with age, in confirmation of which it is stated that when the mail steamer conveying exhibits for the Vienna Exhibition of 1873 was wrecked off Cape Idsou, the cargo laid for fifteen months in ten fathoms of water, and when recovered by divers the antique articles in black lacquer were found uninjured, while those of recent manufacture were completely ruined.

Dyes and Tan Stuffs.—Yellow dyes are obtained from the barks of hadjinoki, dzoumi (a variety of *Pyrus*), koutinachi (*Gardenia florida*), kiwada (*Evodia glauca*), and inoukwada. According to a native writer the bark of *Evodia glauca* is the true kiwada, as giving the finest colour, though the name, signifying literally "yellow skin," is applied to others. Yellow dyes are also extracted from the flowers of *Sophora japonica* and *Sapindus moukouroudji*. Red dyes are obtained from safflower, several native species of madder, and red dye-woods imported from China. A fine claret is produced by digesting alder bark in an infusion of the fruit of the m'me or plum apricot. Blue is extracted from *Polygonum tinctorium*; browns and greys are produced with myrtle and mulberry barks, the fruit of *Rhus semialata*, the bark of *Retinospora obtusa*, &c. Blacks are produced with the help of sulphate of iron, with the barks of various oaks, the bark and fruit of two species of alder, the fruit of *Diospyros Kaki*, of the Japanese chestnut, various galls, notably those found on *Quercus serrata* and the pounded nuts of *Juglans mandshurica*. Some of these substances are used in tanning, more especially the barks of *Quercus dentata* and *Myrica rubra*, which are in great demand among Japanese fishermen for tanning their nets. The fruit of the chiboukaki (a variety of kaki) pounded in water containing lamp-black, gives a black which at a distance resembles oil-paint, and is used in colouring fences and house fronts. It requires renewing every two or three years.

Water Conduits are generally made of bamboo, split or otherwise. Where a larger service is requisite, conduits of square section and formed of some resinous wood are used. Those supplying the city of Tokio are said to have been laid over a century. They are not watertight, and allow of a considerable waste of water.

Porter's Poles.—For heavy loads the stiffest poles, as kachi (evergreen oak), kaya (*Torreya nucifera*); for medium loads, segni (*Cryptomeria Japonica*), moukou, a species of elm and hinoki or retinospora; for light burthens, yenzou *Sophora Japonica*) and bamboo are used. The usual load is 48 lbs. at a run, and 100 lbs. at a walk; distance four leagues, including return empty. At piecework, loads up to 1½ cwt. are thus carried.

Sundries.—Oils for cooking are extracted from the fruit of *Torreya nucifera*, *Juglans mandshurica*, and two kinds of camel-lia; oils for illumination from *Eleococca verrucosa*, the camphor tree and the seeds of the tea shrub; oils for the toilette from ivy berries, and the fruit of *Tarus cuspidata*. Birdlime is manufactured on an immense scale, and of great strength, from the bark of *Ilex integra*. The yield is 2 lbs. of birdlime to 20 lbs. of bark. Amongst other purposes it is employed in catching waterfowl, for which purpose it is spread on bamboo rafts. It

is also used in medicine, externally and internally. The trunks of oaks are largely utilized in growing edible mushrooms. The trees are felled and split in the woods, and left to decay, when they serve as beds for the growth of mushrooms of various kinds, which are afterwards dried for use or export. From six to nine per cent. of the weight of the timber felled is, it is said, thus returned in the shape of mushrooms, which, in view of the difficulties of transport, is found to be a more profitable arrangement than attempting to turn the timber to account in other ways. The export of dried mushrooms from Japan to Chinese ports during the year 1876 was valued at £50,000 sterling.

Note on the Artificial Cultivation of *Qedrus Deodara*.

BY A. SMYTHIES.

THE following brief notes apply to the experience hitherto gained in raising young plants of Deodar from seed in the forests of Jaunsar-Bawar, North-West Himalaya.

The object of the operations carried out in Jaunsar is to increase the quantity of Deodar in forests chiefly consisting of Fir and Oak, but principally to re-stock bare grassy slopes. Two different systems are employed; 1st, sowing the seed directly on bare slopes; 2nd, raising young plants in a nursery and transplanting them.

I.—DIRECT SOWING.—This is effected by sowing the seed in prepared holes or patches along the hill side. The patches are about one foot in diameter, and three or four feet apart, and follow contour lines as nearly as possible. It is not important that they should be at very regular distances apart in the lines, and advantage is taken of any shelter, such as small shrubs and rocks, near or under which the holes are dug; but each line should be almost horizontal. The lines are 15, 20, 25, or 30 feet apart, according to circumstances, being closer together where the slopes to be restocked are very bare, exposed, and far from trees, and further apart where there are already a few young plants, natural seedlings on the ground, or where seed shed naturally from neighbouring trees may lead us to expect seedlings in the course of a few years. The soil in each hole is thoroughly dug, sifted with the hand, and freed from grass and stones, and in November and December, as soon after the seed falls as possible, the holes are sown up, 12 or 15 seeds being scattered over the patch, and lightly covered with soil. The seeds germinate in March and April, not long after the snow has melted and the days begin to get warmer.

Our present experience proves that seed sown before the winter will do much better than seed sown in the early spring; germination is more plentiful, and the young plants are much

stronger and more capable of enduring the heat of the summer and, similarly, slopes with southerly aspect.

There is little to be said regarding the after-treatment of the young plants, firstly, because they require very little tending; and, secondly, because our experience is too recent to enable us to lay down rules on the subject. In a very hot summer it may be advisable to cover the patches with grass shades, or better still with small fir branches, and if the grass in the rainy season shows signs of choking the plants, it may be cut away round each patch; but neither the one operation nor the other is insisted upon, as it is not decided yet whether either is really necessary. Many seedlings dry up in the heat, and some patches will turn out blank; but this would probably happen in spite of all precautions. The aspect, the season, the soil, the seed—all are factors in the problem, whether the young plants live or not, and no fixed rule can at present be laid down.

Many of the young seedlings in April and May are cut down by one or more species of grub, and some patches have been entirely destroyed. The fact was noticed last year (for the first time I believe), and this year we have captured some of these grubs, and endeavours will be made to rear them, and see what the insect turns out to be.

The seeds of the Deodar should be full of transparent liquid resin, should show the first bundle of leaves in the centre, yellowish green, and should run about 3,500 to a pound Avoirdupois.

II.—NURSERY PLANTS.—Seed and nursery beds are prepared in a garden situated almost in the middle of the scene of operations. The seed beds are ordinary garden beds about four feet wide, and the seed is sown pretty thickly in lines 12 inches apart, in November and December. The young plant in the following rains are bedded out into nursery beds. These beds are about four feet broad, and of various lengths, according to circumstances. Good soil is prepared, and heaped up about three inches deep on a hard bottom, which consists of limestone gravel well beaten down. The object of this is to prevent the formation of a long tap-root, induce the growth of bushy roots, and thus render the work of transplanting easier, less costly, and surer in results. The young plants are put out into these beds in lines 12 inches apart, at intervals of 3 inches apart in the lines.

They are covered with light grass shades or mats during the frosts of the early winter, but the mats are removed when snow falls. In the hot weather they are covered up again, and are occasionally watered. The seedlings remain two whole years or more in the beds, and are finally put out into the forest in July, as soon as the rains have well set in. Regarding the age at which they should be put out, we have not much

experience to guide us. Plants five years old (from seed) were put out in July 1879, and up to date are for the most part doing well, but they had long tap roots, which were cut off in every instance at about 18 inches to 2 feet from the crown of the root; the crucial time for these is only just beginning, and if they survive one hot weather, the presumption is, that they are safe. In my opinion, however, it would be better to put them out in the forest younger, at two or three years old, or four at the outside. The distances at which they should be planted out depends entirely on the object in view. 10' \times 10' has been generally adopted in open places.

The old plants mentioned above were dug out with as much soil as would adhere to the roots, were wrapped round with grass, and carried in baskets to the scene of operations. I am not prepared to say that these precautions are necessary, and when we raise plants with short bushy roots, and put them out young, it may possibly be found that no soil or grass is necessary, and that they will be entirely freed from soil in the nursery, and then taken away, and put out with as little delay as possible. When dealing with large areas, a cheap and effective process must be adopted, and it is to be hoped that the system of direct sowing will be successful, and that putting out nursery plants will only be its complement. It is not feasible at present to give the relative cost of these two systems, but it may safely be said that the first one—that of direct sowing—does not cost more than Rs. 5, (about 10 shillings) per acre; any failures involving re-sowing would, of course, increase this figure. The second is much more expensive, involving, as it does, protection of the nursery plants for at least two years and a half.

Memorandum on the Forests of the Kuram Assigned District.

BY C. BAGSHAW, *Deputy Conservator of Forests.*

1. For purposes of description the forests of the Kuram District may be divided as follows:—

- (a).—The Hazár-Darakht forests, extending from Ali Kheyli to the Sirkai Kotal, and lying on both right and left banks of the Hazár-Darakht river.
- (b).—The Hariáb forests, to the north of the river of that name, and between Mounts Matunga and Sika Rám.
- (c).—The Peiwar and Mangiár forests, lying on the east and north-west slopes of the range running from Sika Rám, on which Peiwar and Mangiár are well known points.

(d).—The Kuram forests lying on the southern slopes of the main range between Sika Rám and Karama peaks.

2. The Hazár-Darakht forests are nearly pure deodar. A few juniper (*J. excelsa*) and spruce (*A. Smithiana*) are found in the valleys, and some silver fir (*A. Webbiana*) high up on the ridges and in gorges with a northerly aspect, but deodar forms 90 per cent. of the entire crop.

The forest near the Sirkai Kotal and for several miles down stream have been heavily worked for the supply of the Amir of Afghanistan's works at Kabul, whither the wood was apparently conveyed on camels by forced labour.

No export appears to have taken place from the Hazár-Darakht forests to the plains of India, and the shallow rocky nature of the river seems to forbid floating even during the flood season of March and April. These forests have suffered little from the actions of the villagers. Above and below Rokia cultivation has driven the forest back from the level ground, the trees have been lopped for fuel, and light fellings of poles been made for household purposes. In the Hazár-Darakht forests, as in the Kuram District forests generally, the absence of all under-growth either of shrubs or grass is very marked; fires are consequently of rare occurrence, and are the cause of little damage to the trees: the poorness of the grazing, however, leads to the destruction of much young growth of deodar by sheep and goats.

Owing to grazing, &c., the reproduction in open parts of these forests appears to be in an unsatisfactory state, but information on the point is scanty owing to many parts having been unexplored.

3. The Hariáb forests consist of deodar, Gerard's pine (*P. Gerardiana*) and blue pine (*P. excelsa*) with a few spruce and silver fir, juniper forming a kind of scrubby bush. Deodar appears to form 70 per cent. of the entire crop, and for some miles to the north-east of Matunga, and from that hill towards Ali Khey! the forest is fairly compact and the cover complete, an exception to the rule being some large grassy plateaux in the centre of the forest to the west of Belut.

Should the Kuram river prove one fit for floating sawn timber, these forests may in the remote future yield timber for export to other districts, but their distance from that stream giving a mean land carriage of about ten miles must always prove a great drawback in their value.

The villagers' demand for timber is not large, as they use flat mud roofs, and only want posts, rafters, doors, &c.

In the vicinity of openings in the forest, where grass is found in small quantities, the trees suffer a little from fire, but,

as in other parts, grazing is the greatest enemy the trees have; and in the Hariáb the exclusion of grazing is the first preliminary to working the forests.

The villagers have a lazy way of collecting fuel, viz., by lopping branches, and the outer fringe of forest looks very ragged in consequence. It is remarkable what a short distance the villagers go for fuel, and the small quantity that satisfies them; this may, however, be accounted for by the fact of the upper portion of the Hariáb being abandoned during the winter, owing to the intense cold and a short food-supply, which, I understand, make the inhabitants migrate annually to more genial climes. I have been unable to find out much about the seed of Gerard's pine, at what period it seeds, or what the people do with the crop. It certainly is not in seed generally this year, and none of last year's seed is brought for sale, so I presume that was a non seed year too. In seed years it must be produced in large quantities, and might be made a source of forest revenue by direct collection or the imposition of a tax.

4. The Peiwar and Mangiár forests form, in my opinion, Peiwar and Mangiár
Forests. the most important of the three deodar forests of the Kuram; the block is large, compact, and separated from our own villages. The demands for grazing, fuel and timber, are chiefly made by non-inhabitants, who, the Political Officer tells me, have probably no rights therein. As soon, therefore, as these adjacent tribes are disarmed, and taught to respect English rule, the introduction of forest management by the Forest Department may, should financial considerations permit it, be feasible.

The Peiwar and Mangiár forests may be described as lying on the eastern and western slopes of the Peiwar range, and extend from the Spingawai Pass (or Kotál) to the Mangiár peak; beyond this peak is Mangal territory, and the forests are unexplored.

Along the ridge we find nearly pure deodar until you approach the Mangiár peak, where you get into fir and yellow oak (*Q. semecarpifolia*); and finally getting beyond the limits of forest you reach a bare hill top.

On the eastern slope of the range, after passing through some precipitous ground sparsely covered with deodar, holm oak, blue pine, and juniper, you get on to easier slopes fairly covered with holm oak. High up on the hill side, and in unfrequented gorges, we find this tree growing well, and attaining a girth of 7 feet, and a height of 40 to 50 feet; but lower down and near the road and villages it has been steadily pollarded, and forms a scrub about 12 to 15 feet high. I have not succeeded in ascertaining the rate of growth of the holm oak; the annual rings are very indistinct, and I had no instrument for cutting microscopical sections.

It will probably be found that the only methods of working this particular holm oak forest are, either by regular cuttings in coppice, or by pollarding; probably the latter, as it would be most difficult to close any large part of it for any considerable period, so as to permit the coppice shoots to attain a height of say 7 feet, and so be safe from grazing. This part of the Peiwar forest can only be made useful in meeting the Shalozan fuel demand, and as it is very probable the forests to the north of Shalozan will suffice for this, the forest may be one of those left entirely for villagers.

The western slope of the Peiwar range has a fall of 1,300 feet in ten miles, giving an average gradient of about 1 in 40; the ground is broken up by small gorges and ridges branching out from two main spurs running to Bain Kheyl and Ali Kheyl, the violent action of torrents of melted snow being very marked. Between Ali Kheyl and Mangiár are some extensive grassy plateaux generally bare of trees, and there is a similar plateau close to the Spingawai Pass; the area of the latter, known as the "Sonamurg," cannot be less than 400 acres.

Along the Peiwar range, and for at least $2\frac{1}{2}$ miles to the east, the forest crop consists of deodar, spruce and silver fir, holm oak, blue pine, and juniper; deodar, I think, forms 80 per cent. of the entire crop; in many places it is 95 per cent., but the general average is reduced by some gorges being filled with silver fir. Further west and down to Ali Kheyl, deodar, Gerard's pine, juniper and a few holm oak form the forest, deodar still standing at about 80 per cent. of the whole.

Throughout these forests the bare brown ground, and the almost entire absence of undergrowth, is a very marked feature, comparable to nothing I have seen in Himalayan forests. *Cotoneaster* willow, a *viburnum*, two roses, with some balsams and daphnes, are nearly all the shrubs and undergrowth found, and they have to be sought for.

I have been unable to make any exact examination of these deodar forests, save in the vicinity of the Peiwar Kotal; the results of my observations I append to this memorandum for reference.

The areas I examined are, I think, fair examples, as far as deodar goes, of about half the forest area between Peiwar Kotal, Mangiár and Ali Kheyl, and I think we may put the crop of deodar from 2 feet girth and upwards at 50 trees per acre. Assuming the area at 16,000 acres, this would, deducting 8,000 acres for other classes of forest blanks and precipices, give 8,000 acres at 50 trees per acre, or 400,000 deodar trees. Of these about 17 per acre are first class trees, which gives a reserve of 136,000 trees, average height 100 feet, average girth 7 feet, probable yield in wrought timber 56 cubic feet per tree. The average age of a six-foot tree is 287 years, say

240; and it takes a 4 feet 6 inches girth tree about 60 years to become of first class size. We might apparently, therefore, expect these forests to afford an annual yield of 2,200 trees, or, say, 23,200 cubic feet of wrought timber equal to 35,200 broad gauge sleepers.

These figures are of course but guesses. I believe, however, they convey a fairly accurate idea of the deodar resources of the Peiwar-Mangiar deodar forest.

5. The Kuram forests form a belt along the southern face of the Safed Koh, between Sika Rám and Karama peaks, varying in width from one to five miles, and in elevation from 7 to 11,000 feet.

The forest crop consists of holm oak at from 7,000 to 7,500 feet. Above this, we find it mixed with spruce and silver fir and blue pine. At about 8,000 feet the holm oak decreases, and its place is taken by the yellow oak, and this mixture is found to about 10,000 feet, where the crop is nearly pure silver fir and rhododendron. Deodar is only found in the Spingawai gorge to the extreme west, where a few moss-grown trees are scattered about in precipitous ground.

This forest is naturally divided by ridges into six large blocks, all of which can easily be worked for fuel by mule roads up the gorges, similar to one already made up the Shen Toi to the north-east of the Shalozan cantonment.

The lower parts of these forests are a good deal worked by the villagers for fuel, and as usual they lop branches instead of cutting up large wood. A little temporary cultivation had at times sprung up, but Shinwari raids have apparently tended to stop it.

There is a good deal more balsam and daphne to be seen in these gorges than on the Peiwar range, but the absence of undergrowth is still very marked.

The villagers appear to graze these gorges lightly, and I understand they also allow migratory tribes to graze here in the hot season, when the valleys are unhealthy. On the lower slopes of the hills there is a little grass, which is burnt annually; the fire, however, does not appear to spread into the forest.

6. In the course of describing the different forests I have alluded to the villagers' forest requirements. They may be noted as—

(a).—Bullies and small timber for building, each village using the coniferous wood nearest to hand, and not being prejudiced in favour of deodar.

(b).—Fuel, which they take in the form of branches.

(c).—Leaves for fodder and ground for grazing.

As a rule, they have done wonderfully little damage to the forest in supplying their wants, and the fact has been noticed by many besides myself.

To provide for the wants of the actual inhabitants would in any other part of India be an easy task, and leave large areas of forests unburdened by rights. Here a settlement is complicated by the lawless nature of the people, and by the fact that an unknown number of outsiders have grazed, and cut in these forests without let or hindrance.

In the opinion of the Political Officer at Kuram it will be most unadvisable for years to interfere in the exercise of forest rights beyond putting down the most objectionable practices through the headmen (Maliks) of villages, and clearly making the villagers understand that the forests are not theirs. It therefore is needless, I think, for me to dwell on the definition of forest rights and subsequent assignment of forest reserves.

We now come to the local requirements of Government from these forests. So little has been decided as to the method to be adopted for holding the Kuram that these wants are very indefinite. I am led to believe, however, that for some years they will not exceed—

(a).—12,000 cubic feet of wrought deodar timber per annum.

(b).—120,000 maunds. of fuel per annum.

These supplies are required partly at the Peiwar Kotal or its equivalent, at Ali Kheyl, at Shalozan or its equivalent, and at Kuram. Fortunately in one way, unfortunately in another, the demand can be easily met.

The extensive fellings made for military purposes near the Peiwar Kotal along the ridge towards Mangiär, and dry wood within a two-mile radius of the Peiwar Kotal, will, I am sure, yield at least a lakh of cubic feet of wrought timber; in fact, measurements made to act as a guide give 1½ lakhs as the quantity. We may safely say that the demand for timber is provided for about eight years, or for four years, should it be doubled.

With regard to the fuel demand, the six gorges in the forests to the north of Shalozan (which I have called the Kuram forest) are simply filled with dry trees, the apparent accumulation of ages; they are so blocked up that in some cases the villagers use the ridges as lines of communication. In addition to the wood in the gorges, which was carried thither by the snow, there is standing or fallen dry wood in the forest. At a very low estimate, I am sure dry fuel will yield nine lakhs of maunds, or say, seven years' supply. The fuel demand figure is not, I believe, liable to increase.

The last point to be considered with regard to local demands is how the Government timber and fuel demand is to be

met eight years hence. This question cannot be answered until it has been decided how the forest rights of villagers are to be met, and what areas can be preserved from grazing.

As far as the deodar timber goes, its equivalent, some 250 trees per annum, might be judiciously felled for a century without much damage; but I do not think this idea applies to the fuel demand, and most of the "Kuram Forest" must be closed before fallings equal to the demand can be made.

7. It now remains for me to consider the question of exporting deodar from the Kuram to other districts. I have previously noted that the Hazâr-Darakht river is not fit for floating timber, nor is the Hariâb (or Kariah as it is also called). Of the Kuram river I cannot speak from personal knowledge save from Thul to Kuram. This part of the river is good for floating scantlings in the flood season; and below Thul (in Waziri territory) the river must be good to where it reaches Bannu and thence onwards to the Indus. The unknown water is from Kuram to Ali Kheyl. An obstruction is reported between Chapri and Karkai, but as the natives have certainly floated axed scantlings from Ali Kheyl to Bannu, there is little doubt that the river can be used for floating, and the question of down-country communication as far as water is concerned, may be taken as favourably settled.

The next point for consideration is the unsettled state of the country; this will apparently for some time preclude any extensive working in the forest, or on the river, as large working parties with escorts are not to be thought of. No forest work can possibly pay as long as workmen go in peril of their lives, for labor would under these circumstances be expensive and difficult to import.

The last and most important question is what closed forests we are to have, for until a given area has been closed at least one year, until fairly correct valuation surveys have been made of this closed area, and a plan of operation drawn up and approved, it will be destroying the forest to fell heavily, it will impoverish it to fell lightly, and the latter plan will, for obvious reasons, be financially a failure.

Granted security for life, closed forests, and ample authority for the Forest Department, I do not believe that timber from the most easily worked forest (Peiwar and Mangiâr) can be exported at a profit. The long leads to the river, the difficulties in providing mechanical aids, the enormous rate of wages and the absence of competition preclude for a long time the idea of cheap labor, so that for many years it is pro-

bable 10 feet deodar sleepers could not be placed on the Indus at Kushyagarh for less than Rs. 5 each.

8. The last point requiring attention in this memorandum is the present work of the Forest Department in this valley. Immediate heavy felling by departmental agency being
Forest work in the Kuram Valley.
 inexpedient, the following is the only work left:—

(a).—The prevention of further destruction of the forest, save for strictly military reasons;

(b).—As soon as the Political Officers have decided to close any large forest area, and permit such area to be freely traversed, the examination in detail of the area with the view of ascertaining its value and the possibility of working it at a profit;

(c).—If, as may probably be the case, it be only possible for some time to carry out (a), the Forest Officer might supervise the small timber works for the supply of barrack timber.

The work sketched out requires no large or costly forest establishment: a junior Forest Officer, with one Ranger, one Forester and six Guards could easily carry it on. I would strongly advise his being placed under the orders of the Chief Engineer Officer, with directions to refer through him purely professional questions for the orders of the Inspector-General of Forests.

9. Reference has been made about the possibility of profitably erecting saw-mills in the Peiwar
Saw-mills at Peiwar.
 Kotal forests. There is one stream with

sufficient water for a small mill, but it would not pay owing to the cost of shifting logs to it. The only saw-mill that would pay is, I think, one or more circular saw benches worked by a portable engine; these would cut up planks, shingles, &c., for barracks, and could be moved to the logs.

10. In closing this report, I would again invite attention
Scarcity of grass in the Kuram Forests.
 to the marked absence of grass and undergrowth both within and outside the forest. From a forest point of view, this complicates the working of the forests by rendering the hill side more liable to wash from melting snow. From a military point of view it is very serious as complicating the supply of forage.

(Signed) C. BAGSHAWE,

Depy. Conservator of Forests on special duty.

NOTE.—I would beg to record the great obligations I am under to Surgeons-Major Aitchison and Fleming for information afforded me regarding forests I was unable to visit personally, and through which they had botanised.

(Sd.) C. B.

Description of sample areas under forest examined at and near Peiwar Kotal.

I.

Area two acres ; forms part of the cemetery ravine below, and to the east of the "Block-house" picquet. Elevation about 8,600 feet.

Configuration, gradient and aspect. The ground is undulating ; average gradient 15°.

There is no cut water-course at the bottom of the ravine, but in some places there are hollows formed by the percolation of the snow water. The ravine is sheltered, and snow probably lies late. The aspect is south-east.

Rock and soil. Rock lime-stone, soil clay-loam, with a deep layer of vegetable mould.

In the sample area the crop is pure deodar, in other parts of the ravine a few holmoak are found, forming about 1-50th of the entire crop. There is

very little undergrowth, a poisonous grass growing in tufts, and a few balsam and viburnum being all we find. In the vicinity reproduction of deodar is good in patches that have for some time been exposed to the light ; the seedlings vary in age from two to about thirty years, and have mostly suffered from grazing during the *present year*. Fire has apparently never passed through the forest, but many trees have had patches of bark removed by the villagers.

Enumeration of deodar trees. The enumeration and girth measurements made gave the following results :—

STANDING GREEN DEODAR.			DEODAR STUMPS.			TOTAL CROP DEODAR.			REMARKS.
2 ft. to 4 ft. 6 in.	4 ft. 6 in. to 6 ft.	Above 6 ft.	2 ft. to 4 ft. 6 in.	4 ft. 6 in. to 6 ft.	Above 6 ft.	2 ft. to 4 ft. 6 in.	4 ft. 6 in. to 6 ft.	Above 6 ft.	
5	14	24	61	16	2	66	30	26	{ Stumps and trees measured about three feet from ground. Stumps all new ones.

There are few deodar below 2 feet girth in or near the area measured. An estimate of the height of the deodar here may be formed from the following measurements :—

1.	Girth	10 feet	9 inches ;	height	115 feet.	} Average, 113 feet.
2.	"	10	"	3	113	
3.	"	9	"	5	106	
4.	"	10	"	6	127	
5.	"	12	"	2	103	

Trying to ascertain the rate of growth of deodar in these forests was very difficult, owing to the large number of rings per inch, and I had to adopt the plan of getting the tops of stumps cut off, and a selected plane or sloping line smoothed with a plane before I could, with any accuracy, count the annual rings: even then I was often in doubt, and the following must only be taken as approximately correct:—

Number.	Approximate girth in inches of stump about 3 ft. 1 in. from ground.	Radius counted in inches.	RINGS COUNTED ON RADIUS.					Total number of rings counted.	Average per inch per tree.	Average per inch for locality.	REMARKS.
			0 in. to 4 inches.	4 in. to 6 in.	6 in. to 8 in.	8 in. to 9 in.	Above 9 in.				
1	51	8	118	51	54*	223	27.87	25.46	*No. rings in 3 inches—1 inch, &c.—vide radius. Larger stumps not available.
2	45	7	96	54	31*	...	...	180	25.71
3	63	10	90	37	45	13*	...	185	18.50		
4	44	6.75	121	89	12	...	...	172	25.48
5	45	7	141	35	17*	...	...	193	27.57
6	42	6.25	97	87	9*	...	...	193	30.88

The girths were taken over the bark, the average thickness of deodar bark in the Peiwar forest being about .66 of an inch. The *girths* are approximate only, as in some cases the stumps were chipped or broken. Twenty years have been allowed for the growth of a deodar to three feet from the ground, and that number has been added to the number of rings actually counted in the first four inches of radius. I arrived at this figure after counting the rings in a good many saplings, when I found unsuppressed and undamaged specimens took from 20 to 25 years to attain a height of 3 to 4 feet.

Summary.

The previous observations may be summarised as follows:—

The deodar crop on a south-east slope was found to be—

(a).—60 trees of all classes per acre.

(b).—Average height of 1st class trees 113 feet.

(c).—Assuming the average growth per inch to be 25.46 annual rings, the average age of a 6-foot tree appears to be 290 years.

The latter figure is founded on so few data that I only regard it as a guess, and as one that makes the average growth slower than it really is. Slow growth in this ravine may be accounted for by the snow lying late and dryness at other seasons owing to the aspect.

The fellings in this and other places near the Kotal were made last winter for military reasons, and no further remark on the subject is necessary here or in other parts of this memo.

General.

II.

Area two acres, which are near the Kotal, and to the south of the Kotal and Ali Kheyl road. Elevation about 8,500 feet.

Area and locality.

Configuration, gradient and aspect.

Unbroken slopes with no rock appearing on surface. Gradient 20°. Aspect east to north-east.

Rock and soil.

Limestone is found in the vicinity. Soil deep clay, with much vegetable mould.

In the sample area pure deodar, saving the presence of two or three holm oak and a juniper; in the vicinity there are about three spruce fir

Stock.

to be seen in as many acres of forest. There may be said to be no undergrowth, a few unhealthy viburnum and balsam being all we find; grass is entirely absent. There is no reproduction to be seen; this is probably due in part to the unfavorable aspect, in part of the main road of the country being so close at hand, which animals would graze along, and thus prevent the germination of seed. The forest has not suffered from fire, but some trees have been barked by villagers.

The valuation survey gave the following results :—

Enumeration of Deodar.

GREEN DEODAR.			DEODAR STUMPS.			TOTAL CROP.			REMARKS.
3 feet to 4 feet 6 inches.	4 feet 6 inches to 6 feet.	Above 6 feet.	3 feet to 4 feet 6 inches.	4 feet 6 inches to 6 feet.	Above 6 feet.	3 feet to 4 feet 6 inches.	4 feet 6 inches to 6 feet.	Above 6 feet.	
5	31	44	43	27	19	48	58	63	A few stumps are old.

The following heights were taken :—

1.	Girth	12 feet 8 inches	height	73 feet	} 80 feet average.
2.	"	6 "	2 "	89 "	
3.	"	9 "	1 "	82 "	
4.	"	7 "	0 "	86 "	
5.	"	8 "	7 "	70 "	

The growth of deodar in this aspect may be judged by the following :—

Number.	Approximate girth in inches at 3 feet.	Mean radius in inches.	RINGS COUNTED ON RADIUS.					Total number of rings.	Average number per inch per tree.	Average number per locality per inch.	REMARKS.
			0 inch to 4 inches.	4 inches to 8 inches.	8 inches to 9 inches.	9 inches to 12 inches.	Above 12 inches.				
1	53	925	78	30	75	6*	...	196	21.40	20 80	See remarks and notes in memo. on area I. * No. rings in 25 — 2 inches, 1.50 inches, &c.—vide radius.
2	87	14	58	38	68	44	25*	233	16.64		
3	57	9	88	56	76	...	...	230	24.44
4	48	7.50	64	50	38*	...	...	153	20.26
5	65	10	76	32	62	17*	...	167	18.70		
6	66	10.50	88	49	56	3.5*	...	218	20.76		
7	65	10.25	67	37	56	11*	...	171	16.68		
8	67	10.75	111	22	23	26*	...	182	16.93		
9	65	10	96	21	32	10*	...	158	15.80		
10	62	9.75	73	66	65	29*	...	233	23.89		
11	49	7.75	65	53	59*	...	...	177	22.83
12	50	7.75	58	52	95*	...	...	205	26.45
13	46	7.25	75	63	58*	...	...	196	27.03
14	75	12	44	20	66	64	...	194	16.16		
15	63	9.50	79	23	120	9*	...	236	24.84		
16	48	7.50	94	37	20*	...	...	151	20.13
17	54	8.50	111	27	23*	...	...	161	13.94
18	42	6.50	84	44	11*	...	...	139	21.38
19	84	13.25	60	25	53	50	17*	206	15.47		
20	49	7.50	94	38	35*	...	...	213	23.26

Although the variations in the observed growth are considerable, the number of annual rings in the first four inches of radius varying between 44 and 111, I think the figures are fairly reliable, and believe it will be found that a first class tree 6 feet in girth takes about 231 years (probably more than less) to grow.

It will be noted that in this sample area there were 84 deodars 2 feet girth and upwards per acre; the average height however was only 80 feet.

III.

Area two acres, situated on the right slope of the "Gordon Highlanders" gorge to the left of the Kotal and Ali Khey road.

Configuration, gradient and aspect.

Unbroken slopes; average gradient 25°, with occasional bits of level ground. Elevation about 8,700 feet. Aspect north-west.

Rock and soil.

Metamorphic rock with traces of iron. Soil deep, sandy, with much vegetable

mould on surface.

In the sample area pure deodar; in the vicinity a few spruce and silver fir with some young blue pine are found.

Stock.

Near the sample area is a clearing of about three chains square; this is nearly covered with saplings of about 4 feet

high; the growth consists of silver fir (9-10th), deodar (1-20th), spruce with a few blue pine (1-20th); beyond this clearing and in more shade are a few apparently *older* deodar and some sickly blue pine saplings. This clearing is surrounded on three sides by deodar, but nearly open on the ravine side (north-west); it has two or three seed-bearing deodar in the middle, and at the bottom of the ravine, about 50 yards away, are three solitary silver firs. It is quite possible this displacement of deodar by silver fir is due to the seed of that tree falling soon after the clearing was made, and before any deodar seed fell. On the other hand, I have in many places noted a decided tendency on the part of the silver fir to encroach on deodar growing on northerly aspects.

There was little or no undergrowth in this area.

Enumeration of Deodar.

GREEN DEODAR.			DEODAR STUMPS.			TOTAL CROP.			REMARKS.
2 feet to 4 feet 6 inches.	4 feet 6 inches to 6 feet.	Above 6 feet.	2 feet to 4 feet 6 inches.	4 feet 6 inches to 6 feet.	Above 6 feet.	2 feet to 4 feet 6 inches.	4 feet 6 inches to 6 feet.	Above 6 feet.	
11	33	30	30	4	...	41	37	30	Partly old, partly new stumps—Few poles below 2 feet girth.

The height of the deodar here may be judged from the following measurements made:—

1. Girth 6 feet 9 inches; height 76 feet	Average height 77 feet.
2. " 8 " 6 " " 70 "	
3. " 7 " 0 " " 71 "	
4. " 6 " 6 " " 79 "	
5. " 7 " 8 " " 84 "	

The following number of stumps were examined to determine rate of growth; all the stumps were not in the sample area:—

Number.	Approximate girth of tree at 3 feet in inches.	Mean radius measured in inches.	RINGS COUNTED ON RADIUS.					Total number of rings.	Average number per inch per tree.	Average number per inch per locality.	REMARKS.
			0 inch to 4 inches.	4 inches to 6 inches.	6 inches to 9 inches.	9 inches to 12 inches.	Above 12 inches.				
1	53	8	149	43	32	224	28.00	22.33	No. in 1 inch, $\frac{1}{4}$ inch, &c.—vide radius measurement.
2	90	14.50	84	39	69	64	39	295	20.34		
3	65	10	67	57	72	23	...	219	21.90		
4	56	8.75	76	47	71	...	...	194	22.17
5	78	12.75	53	27	54	54	16	204	16.00		
6	50	7.75	97	94	29	...	...	220	28.38
7	51	8	56	71	75	...	...	202	25.25

In this part of the forest with a north-west aspect, we find 49 trees of all classes per acre, average height 77 feet; age of a six-foot tree about 254 years.

IV.

Area and locality.

Area, two acres to right of Ali Khey and Kotal road, and beyond the Engineers' workshops.

The hill side is a good deal cut up by small water-courses, and has occasional bits of level ground with some abrupt rocky slopes; gradient 27°; elevation 8,660 feet; aspect southerly.

Configuration, gradient and aspect. Limestone; soil poor, yellow clay with very little vegetable mould. The hill side has suffered from

Rock and soil. the wash of the snow water; some water springs are found near this sample area.

Deodar with a few holm oak and juniper. Undergrowth very little, consisting of viburnum, wild flax and thistles. Reproduction entirely absent. A few trees about here have been injured by fires lit at their bases, and by barking.

Enumeration Survey.

GREEN DEODAR.			DEODAR STUMPS.			TOTAL CROP.			REMARKS.
3 feet to 4 feet 6 inches.	4 feet 6 inches to 6 feet.	Above 6 feet.	3 feet to 4 feet 6 inches.	4 feet 6 inches to 6 feet.	Above 6 feet.	3 feet to 4 feet 6 inches.	4 feet 6 inches to 6 feet.	Above 6 feet.	
2	6	21	21	11	16	23	17	27	Stumps partly old, partly new.

The following heights were noted: —

1.	Girth	11 feet 6 inches;	height	85 feet	Average height 79 feet.
2.	"	9 "	8 "	89 "	
3.	"	9 "	10 "	79 "	
4.	"	8 "	11 "	70 "	
5.	"	11 "	1 "	78 "	

Number.	Approximate girth of trees at 3 feet in inches.	Mean radius measured in inches.	RINGS ON MEAN RADIUS.					Total number of rings.	Average number of rings per inch per tree.	Average number of rings per inch per locality.	REMARKS.
			0 inch to 4 inches.	4 inches to 6 inches.	6 inches to 9 inches.	9 inches to 12 inches.	Above 12 inches.				
1	78	12.60	81	21	25	25	7	159	12.73	14.52	Nos. on 1 inch, 75, 25 &c. — <i>vide</i> radius.
2	90	14.60	54	22	44	40	26	186	12.82		
3	84	13.60	69	36	15	14	...	184	9.92		
4	60	9.25	75	50	83	3	...	211	22.81		
5	71	11.25	65	33	55	43	...	196	17.42		

It will be seen from the preceding that the crop is only 39 trees per acre, and the average height but 79 feet. On the other hand, the growth is the most rapid yet found in these forests, a first-class tree taking only 165 years to grow. The rapidity of growth may be attributed to the trees growing on a sheltered southern slope in the vicinity of water.

V.

About two and a half acres, lying about the hospital towards the Spingawai Pass.

Area and locality.

The ground is steep and rocky near the main ridge, with huge masses of limestone protruding through the soil. The side spur, on which the sample area is, is rounded and even; the area measured runs into the ravine or dip between it and the next side spur. Gradient 23° to 25° . Elevation about 8,750 feet. Aspect southerly.

Rock and soil.

Limestone; soil clay; vegetable mould plentiful, save on ridge.

Deodar and holm oak, with a little undergrowth of wild roses and viburnum. All the deodar have been felled and most of the oak. A large part

Stock.

of the hill side was burnt last summer when covered with leaves and branches, &c.; in the unburnt portion a good many deodar seedlings are visible; these are apparently two years' old; a few oak seedlings and coppice shoots are also found.

DEODAR STUMPS.			OAK STUMPS.			GREEN OAK.			TOTAL CROP, DEODAR AND OAK.		
2 ft. to 4 ft. 6 inches.	4 ft. 6 inches to 6 ft.	—	All Sizes.	—	—	All Sizes.	—	—	All Sizes.	—	—
36	46	63	127	...	...	49	...	...	321	...	...

This gives 58 deodar per acre, 128 deodar and oak per acre.

The following form gives the measurements of some of the deodar as found lying on ground after their tops and branches had been cut for fuel :—

Number.	Girth at butt end of tree about 4 feet from ground.	Girth at 14 feet from ground.	Girth at 34 feet from ground.	Girth at 54 feet from ground.	Girth at 74 feet from ground.	Girth at 94 feet from ground.	Girth at 114 feet from ground.	Girth at 134 feet from ground.	Girth at 154 feet from ground.	Girth at 174 feet from ground.	Girth at 194 feet from ground.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
1	9 0 8	6 7 6	6 0 4	6 0 4	6 0 4	6 0 4	6 0 4	6 0 4	6 0 4	6 0 4	6 0 4
2	8 0 6	5 5 2	4 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3
3	8 0 6	5 5 2	4 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3
4	8 0 6	5 5 2	4 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3
5	8 0 6	5 5 2	4 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3
6	8 0 6	5 5 2	4 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3	7 10 3
7	12 0 9	7 9 6	6 8 0	6 8 0	6 8 0	6 8 0	6 8 0	6 8 0	6 8 0	6 8 0	6 8 0
8	9 0 7	0 6 3	5 9 5	3 4 2	3 3 2	3 2 9	3 2 9	3 2 9	3 2 9	3 2 9	3 2 9
9	4 0 4	0 4 0	4 0 3	3 8 0	2 8 1	2 8 1	2 8 1	2 8 1	2 8 1	2 8 1	2 8 1
10	7 9 7	3 6 6	5 3 5	3 4 0	3 4 0	3 4 0	3 4 0	3 4 0	3 4 0	3 4 0	3 4 0
11	6 3 5	2 4 2	3 7 3	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0
12	7 0 6	10 6 2	5 7 4	6 4 3	6 4 3	6 4 3	6 4 3	6 4 3	6 4 3	6 4 3	6 4 3
13	9 0 7	4 6 6	5 11 5	0 4 3	3 8 0	3 8 0	3 8 0	3 8 0	3 8 0	3 8 0	3 8 0
14	11 0 9	9 9 0	8 0 7	0 6 6	5 6 4	6 3 9	6 3 9	6 3 9	6 3 9	6 3 9	6 3 9
15	5 0 4	9 5 0	4 9 4	6 4 0	3 0 0	3 0 0	3 0 0	3 0 0	3 0 0	3 0 0	3 0 0
16	6 8 6	0 5 6	5 0 3	6 3 0	6 3 0	6 3 0	6 3 0	6 3 0	6 3 0	6 3 0	6 3 0
17	11 0 12	0 10 6	9 9 8	2 8 0	7 2 6	5 3 8	5 3 8	5 3 8	5 3 8	5 3 8	5 3 8
18	7 8 8	0 8 0	7 8 7	6 7 0	6 9 0	6 9 0	6 9 0	6 9 0	6 9 0	6 9 0	6 9 0
19	7 9 7	3 7 2	5 0 4	8 3 8	8 3 8	8 3 8	8 3 8	8 3 8	8 3 8	8 3 8	8 3 8
20	10 0 9	3 8 9	8 6 8	3 7 3	6 6 6	6 6 6	6 6 6	6 6 6	6 6 6	6 6 6	6 6 6
21	8 0 8	0 7 3	6 11 6	6 0 5	9 4 6	9 4 6	9 4 6	9 4 6	9 4 6	9 4 6	9 4 6
22	8 2 8	0 7 6	6 9 5	10 5 3	4 11 0	4 11 0	4 11 0	4 11 0	4 11 0	4 11 0	4 11 0
23	8 8 8	0 8 4	6 9 6	1 5 6	6 3 9	6 3 9	6 3 9	6 3 9	6 3 9	6 3 9	6 3 9
24	10 0 8	3 7 0	6 3 5	3 5 0	3 9 2	3 9 2	3 9 2	3 9 2	3 9 2	3 9 2	3 9 2
25	7 0 7	0 6 6	6 6 3	5 0 4	4 3 6	4 3 6	4 3 6	4 3 6	4 3 6	4 3 6	4 3 6
26	6 8 5	6 4 9	4 0 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3
27	8 9 8	9 7 9	7 3 6	0 5 0	4 0 2	3 9 0	3 9 0	3 9 0	3 9 0	3 9 0	3 9 0
28	7 0 6	3 5 9	4 9 4	6 1 0	6 1 0	6 1 0	6 1 0	6 1 0	6 1 0	6 1 0	6 1 0
29	9 0 8	6 8 4	6 9 5	1 0 4	3 4 0	3 4 0	3 4 0	3 4 0	3 4 0	3 4 0	3 4 0
30	6 3 5	9 5 0	4 8 4	8 4 0	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6
31	6 3 5	8 5 0	4 8 4	8 4 0	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6
32	8 9 6	0 5 0	4 9 3	6 2 6	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3
33	8 0 7	3 6 3	5 6 4	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3

This sample area was selected as one largely stocked with oaks, and as affording a good opportunity of measuring a number of trees. It was found, however, that the trees had been so much damaged in the collection of fuel that the measurements of only one-fourth were worth recording.

Rate of growth.

Number.	Approximate girth at about 3 feet from ground in inches.	Mean radius counted in inches.	RINGS COUNTED ON RADIUS.					Total number of rings.	Average number of rings per inch per tree.	Average number of rings per inch per locality.	REMARKS.
			0 in. to 4 in.	4 in. to 6 in.	6 in. to 8 in.	8 in. to 12 in.	Above 12 in.				
1	84	13.50	64	17	77	118	60	336	24.68	21.61	No. rings 75, 100, 200, 225, &c. — wide radius.
2	73	11.50	118	68	86	43	...	310	26.95		
3	81	13.	95	67	68	52	17	294	22.61		
4	78	12.50	117	54	79	43	8	301	24.08		
5	81	13.	118	42	66	34	9	269	20.69		
6	92	15.	74	31	41	67	121	334	22.26		
7	71	11.	67	21	45	35	...	168	15.27		
8	121	19.75	56	41	32	34	186	349	17.67		

It will be noted that while the aspect of this plot is southerly, the growth is much slower than in the godown plot (No. 4). This may be accounted for by the dry nature of the spur, rock being near the surface, &c., but also tends to show that growth near the godown is abnormally quick. The age of a first class tree (6 feet girth) appears to be 246 years in the hospital plot, or slower in growth than an average tree in these forests.

The "Parish" Tree.

TO THE EDITOR "INDIAN FORESTER."

DEAR SIR,—When you and I were at school together you were already a boss at botany, and I know you have continued the study. I have never been able to get hold of a really tough nut for you till now, but here's one. Unfortunately I have not found the tree—worse luck—but I have heard of it. In the vulgar tongue of these parts it is called "Parish." It is very rare indeed. I have only heard of one person who has found it. Here goes for the real true history as told to me. About the time the Dekhan came under British rule there lived, in a deserted village called Nasratpur, an old "Gosavi," who kept two or three goats. A young Mussulman used to herd these goats. The Gosavi soon learnt that the goats had found the Parish, in the search for which he had grown old. By questioning the herd the wicked old man found the tree, and immediately set to work, and cut it down and carried it home. He made a huge cauldron and set to work to boil down the tree (for catechu I presume), and then tried to throw in the herd boy, but the biter was bit, and the herd boy threw him in instead. When the fire was out the poor herd boy found his friend, the Gosavi, a solid block of *gold*. He broke off one of the

Gosavi's fingers to see if it was gold all through, when, wonderful to relate, the finger immediately grew again. Then the truth dawned on him. He had found the "Parish." He was now master of untold wealth, and immediately bought Nasratpur, and swore a mighty oath that no one should ever profit by the rain which fell on his land. He set to work, and wherever (on his boundary) the land sloped outwards, he built a mighty wall so as to keep his own rain to himself. But this sort of thing could not last, and the English became envious of his "Gosavi," and sent a force to rob him of "it." But the man was depraved at heart, and sooner than surrender his treasure, he cast it into the village well. The English put on 16 pairs of bullocks and worked the well night and day for 16 months, but could not reduce the water a finger's breadth for was not the "Parish" in it, and so gave it up. Hence you see that the Parish is economically a most valuable tree. As I said before I cannot send you specimens, because I have not yet met the tree, but when I do, I'll——take furlough.

GHATI.

P.S.—The above story must be true, because I've camped at Nasratpur and seen the walls and the well. I thought of trying a dive, but the water was too cold.

The Changa Manga Plantation Working Plan.

TO THE EDITOR "INDIAN FORESTER."

DEAR SIR,—There was a grand flourish of trumpets at one time over the Changa Manga Reserve and its working plan. From what I saw at the Reserve, and heard of its working plan, I was led to think that the working plan was a complete failure, its calculations being proved wrong at every turn by the stern logic of facts. It would be most interesting to me, and others I know, to see a sketch comparing the hopes and expectations of the working plan with actual results. Is there no trained officer in that neighbourhood who will satisfy the curiosity of

"A FORESTER FROM AFAR?"

P.S.—I had intended to go and have a look for myself last November, but a stern Government refused my privilege leave.

[*Note.*—We must remind our correspondents that we cannot publish letters or communications signed with a *nom de plume*, when not accompanied by a card, or other intimation of the author's identity.—Ed.]

II. OFFICIAL PAPERS.

Despatches regarding the Superior Staff of the Forest Department in India.

From the Secretary of State for India to His Excellency the Right Honourable the Governor General of India in Council, dated London, 18th March 1880.

MY LORD,—1. I have considered in Council Your Excellency's letter No. 29, of the 19th December last, submitting, for my sanction, orders passed by Your Excellency regarding the redistribution of the superior staff of the Forest Department in the provinces directly under the administration of your Government, and the method and extent to which it should be annually recruited.

2. The present proposals will have the effect of localizing the Forest Department to a greater extent than has hitherto been the case. I have in a recent despatch expressed an opinion in favour of decentralization of forest administration, and so far as this is concerned, your present proceedings have my approval.

3. In order to carry out this arrangement, however, you have found it necessary to recommend the retention on the staff of the Forest Department, for two years, of the four officers set free from Mysore. In the present state of forest administration in India, it would scarcely seem advisable to reduce the existing establishment; much remains to be done in the provinces under your Government, as elsewhere, in the reservation and demarcation of forests, and these are works of such imperial interest that, until they are completed, it will scarcely be possible to entertain any question for reduction in this department of the State. In your proposed distribution of the existing staff you appear to have carefully considered the requirements of the several provinces concerned, although you have been unable at present to meet demands for additional officers made by the Governments of Bengal, Assam, and Burma. These are claims, however, which will have to be taken into consideration before long, and will no doubt be duly entertained when any further changes in the distribution of officers may become practicable. In two years' time the whole question will again come under review, and I trust that you will then be able to place the provincial lists of establishments on a permanent footing.

4. With regard to the system of filling vacancies in the superior branches of the department, you are of opinion that, for many years to come, it must be chiefly recruited by the appointment of officers who have received their professional training in the State forests of Europe, and you express a desire that six recruits may be annually selected in this country. The necessary steps will be taken for giving effect to your wishes in this respect. I must, however, point out that, judging from the experience of past years, the nomination of six candidates annually for training at Nancy will not necessarily secure that number for appointment at the expiration of their course of education, as from one cause or another a certain number of those nominated fail to complete the course and to receive appointments.

In filling up any vacancies that may occur in excess of the numbers sent out from this country the greatest care must be taken in the selection of candidates, as it is very undesirable that persons with inferior qualifications should be appointed to equal rank with the highly trained foresters from Nancy. This difficulty may probably best be met, and the numerical strength of the establishment maintained, by increasing the staff of native Sub-Assistant Conservators from time to time, as unfilled vacancies occur in the higher grades, and by employing the best qualified amongst them as acting Assistant Conservators so far as that may be found practicable. By this means the scope for the employment of natives in the Forest Department would be enlarged, and the necessity of appointing insufficiently qualified persons to the higher branches of the service obviated.

6. The appointment of natives as Sub-Assistant Conservators is a measure which has on more than one former occasion received the approval of Her Majesty's Government; and I am of opinion that, as far as possible, this class should be filled by the appointment of natives. The arrangements now reported for training candidates for this branch of the service seem sufficient, and have my approval.

CRANBROOK.

From the Government of India, in the Home, Revenue, and Agricultural Department, Forests, to Her Majesty's Secretary of State for India. FORT WILLIAM, the 19th December 1879.

MY LORD.—In our despatch No. 285 (Financial), dated the 29th July 1878, we solicited Your Lordship's sanction to the establishment of a forest school, intended chiefly to train candidates for the executive branch of the forest staff, and we particularly solicited sanction to the appointment of two additional officers of the class of Deputy Conservator required in order to organize that institution. In despatch No. 36, dated the 24th October last, Your Lordship's assent was communicated to the establishment of the forest school, but the two additional appointments were not sanctioned.

2. In our despatch No. 25, dated the 28th January 1879, we represented to Your Lordship the insufficiency of the staff sanctioned for the Government forests in British Burma, and requested sanction to an increase of two Assistant Conservators and to the filling of an appointment of Deputy Conservator, 2nd grade, then held in abeyance. Your Lordship's reply No. 14, dated the 17th April 1879, sanctioned the filling up of the appointment of Deputy Conservator, but declined to sanction the other two appointments.

3. Again in our letter No. 64 (Financial), of the 28th February 1879, we submitted proposals for an increase to the superior staff of the Forest Department in the Central Provinces, and reported that we had meanwhile transferred two Assistant Conservators to those Provinces, who, on the reduction of the forest establishment in Mysore, had become supernumeraries.

In reply to this application Your Lordship sanctioned in despatch No. 215 (Financial), dated the 29th May last, the addition of one Deputy Conservator of the 3rd grade, and, as regards the two supernumerary Assistant Conservators, expressed your opinion that they should remain on the supernumerary list. On this, as well as on previous occasions, Your Lordship urged the necessity of employing qualified native agency in order to supplement deficiencies in the superior staff.

4. For several years past the Punjab Government has urged the insufficiency of the staff sanctioned under Your Lordship's orders at the re-organisation of the superior forest staff in 1876. From the late annual reports of forest administration in the Punjab Your Lordship will have noticed that the demarcation and settlement of the reserved forests in that Province has not made good progress, and this is mainly ascribed by the Punjab Government to the insufficiency of the forest staff allotted to that Province. We would specially invite Your Lordship's attention to the report for 1878-79, and to the orders of His Honor the Lieutenant-Governor thereon, copy of which, together with our orders, we submit for Your Lordship's information with this despatch.

5. It has also been represented to us that the staff sanctioned for the Oudh forests in 1876 is insufficient, and similar representations have been made to us from Bengal and Assam.

6. These circumstances have compelled us to make a re-distribution among the different Provinces of the superior staff sanctioned in 1876, and to increase the number of Sub-Assistant Conservators. At the same time we have carried out the intention which we expressed in

* Circular Resolution, No. 30, dated the 13th October 1876, forwarded with despatch to the Secretary of State, No. 22, dated the 19th October 1876.

our orders of the 13th October 1876,* viz., to localize that staff to a greater extent than was possible at that time. The orders embodying these changes will be found in our circular No. 42 F, dated the 27th October last, copy of which is appended to the present despatch.

7. Your Lordship will observe that the total number of Deputy and Assistant Conservators remains unchanged; but the total includes four officers of these classes who became supernumerary on the reduction of the staff in Mysore, two of whom were transferred to the Central Provinces, as already explained, while two were employed in other Provinces. These four supernumerary appointments we have been compelled to retain as a temporary measure, and we have fixed the time of their retention at two years, after which period the present distribution must be re-considered.

8. In this manner, and by means of a re-arrangement, the details of which will be seen from our orders quoted, we have been enabled temporarily to add three Deputy and Assistant Conservators to the Punjab, and two to the North-Western Provinces and Oudh, while the addition of one Deputy Conservator to the staff of the Central Provinces

is made as a permanent arrangement under Your Lordship's sanction. To each of the six local lists established by us we have allotted four Sub-Assistant Conservators, all or nearly all of which appointments will in future be filled by the appointment of natives.

9. The number of Conservators sanctioned in 1869, and which remained unchanged at the re-organization of 1876, was seven. One of these (the Conservator of Mysore and Coorg), being no longer required by the Chief Commissioner, has been omitted from the return. Captain VanSomeren, the incumbent, is supernumerary, but is on leave at present. On the other hand, one additional Conservator has been sanctioned for British Burma, and a second for the School Forests in the North-Western Provinces, so that the total number of Conservators is now eight; and as the appointment of one Deputy Conservator is held in abeyance for the Conservator of the School Forests, the number of Deputy Conservators is 30, as before, including the new appointment sanctioned by Your Lordship for the Central Provinces. From the 1st of April next we have decided to raise the chief Forest Officers in Assam and Berar to the rank of Conservators, without increasing their pay, the appointments of two Deputy Conservators of the 1st grade being held in abeyance in their places.

10. Your Lordship will observe that an essential part of this arrangement is the allotment to each Province of a sufficient number of Sub-Assistant Conservators to fill temporary vacancies among Assistant Conservators in those cases in which a sufficient number of professionally trained officers from home is not available to fill such vacancies.

11. A portion of these Sub-Assistant Conservators will always be probationers under instruction at the Forest School, and while thus on probation and under instruction they will receive a lower rate of pay. These probationers will in future, as a rule, be natives, and will either be selected from among promising Forest Rangers, or they must be otherwise specially qualified. But no probationer will be eligible for promotion to the rank of Sub-Assistant Conservator, unless he has served a certain time as a Forest Ranger in the executive branch of the service. In this manner the wish repeatedly expressed by Your Lordship will be carried out, to employ native agency on a more extended scale than has been done hitherto.

The arrangement made to give effect to this part of our programme will be found detailed in Circular No. 40 F, dated the 23rd October 1879, copy of which is appended to the present despatch.

12. We take this opportunity to transmit to Your Lordship a copy of the report which our Inspector-General of Forests has submitted to the Government of the North-Western Provinces and Oudh on the inspection of the School Forests made by him last year. The general principles by which the professional training of probationers and apprentices in these forests shall be conducted having now been laid down, it will be left to the Government of the North-Western Provinces, in communication with the other Local Governments, and under the advice, when necessary, of our Inspector-General of Forests, to carry out our views regarding the professional training of native probationers and apprentices at the Forest School.

13. It now remains to explain how far the existing system of recruiting the superior branches of the Forest Department by the appointment of officers who have received their professional training in the State Forests of Europe will be affected by the arrangements now reported. We entertain no doubt regarding the general excellence of this system, and the good results derived from it, and in this respect we adhere to the views recorded in our despatch No. 6, dated the 23rd February 1877. For many years to come the superior staff of the Department must chiefly be recruited by the appointment of officers who have received their professional training under that system, and this, in our opinion, relates equally

to the Presidencies of Madras and Bombay as to the several Provinces of the Bengal Presidency.

14. The total number of appointments of Conservators, Deputy and Assistant Conservators sanctioned for the three Presidencies stands as follows:—

			Inspector-General and Conservators.	Deputy Conservators.	Assistant Conservators.	Total.
India	...	...	9	30	54	93
Madras	...	...	1	5	10	16
Bombay	...	...	3	6	14	23
			—	—	—	—
TOTAL	...	...	13	41	78	132
			—	—	—	—

15. During the nine years from 1870-71 to 1878-79 the casualties in the staff under the Government of India have aggregated 35, the average strength during that time having been 81. Thus the casualties have during this period amounted to 4·3 per cent. But the first years of a new department, in which nearly all officers are young men, cannot be expected to give reliable data; and we anticipate that hereafter, when retirements on pension will have commenced, the loss from deaths and retirements may be heavier. In our despatch of February 1877, we stated it as our opinion that the permanent vacancies would be from 5 to 6 per cent. annually, and as yet we have seen no reason to modify this estimate. For the Madras and Bombay Presidencies no data are available, but assuming 5 per cent. as a probable rate, the number of recruits required annually to provide for permanent vacancies in a staff of 132 officers would be 6·6.

16. At the same time we must bear in mind that the work is steadily and necessarily expanding, and that we have frequent calls for forest officers to be employed in new fields of work. Lately we found ourselves obliged to make an officer available at short notice for the examination and working of the forests in the Kuram District. The Chief Commissioner of the Andamans is anxious to employ a professionally trained forest officer to take charge of the forest operations at that settlement. One or two officers will shortly be required for Arracan in British Burma, and the Governments of Bengal, the Punjab and the Central Provinces are urgent in their applications for additional men. For the Forest School we have as yet only been able to provide one professionally-trained officer, and the urgent demand for a forest officer from the Government of the Mauritius has, to our regret, hitherto remained unfulfilled, because we have not a suitable officer to spare for the duty.

17. The pressing demands of the Provinces of the Bengal Presidency and the small number of recruits during the last four years have compelled us since 1876, to appoint a considerable number of men selected in this country; and though they were selected with great care, and educational tests and other special qualifications are rigorously insisted upon, the men selected in this country, whether natives or Europeans, cannot be expected to be as useful as the men selected at the India Office, who receive a regular professional education before they are sent out to this country.

18. Under these circumstances we are of opinion that, from and after the year 1881, it will be well to select six candidates annually on the same understanding as that contained in paragraph 23 of our despatch No. 6, dated the 23rd February 1877, *viz.*, that if in any year six thoroughly competent candidates do not come forward a smaller number should be selected.

19. As we have in this despatch adverted frequently to the growth of forest business in India, and to the need for increased staff in several

Provinces, it may be well for us to assure Your Lordship that, though the great aims of the Forest Department are to husband the timber and forest produce supply for future generations, and to prevent avoidable denudation of the country, yet the important object of making the Forest Department pay and yield a constantly increasing surplus revenue has not been foregone. The growth of the forest revenue during the past ten years may be seen from the annexed Table, which shows that the surplus yielded by the Forest Department has risen from Rs. 14,00,000 a year in 1867-68 to Rs. 28,00,000 a year in 1877-78.

20. We may briefly summarise the matters discussed in this despatch as follows :—

- (1) we describe, and submit for Your Lordship's information, the orders recently issued for partially localising the staff of the Forest Department ;
- (2) we describe, and submit copies of the orders recently issued for appointing and training probationers, chiefly Natives of India, for Sub-Assistant Conservatorships ;
- (3) we submit papers showing the arrangements made for imparting instruction in forest management at the Forest School ;
- (4) we report, and solicit sanction to, our decision to retain for two years as supernumeraries the four forest officers set free from the Mysore forests ;
- (5) we submit, for Your Lordship's consideration and adoption, the recommendation that for the future six recruits be selected in England annually for the work of the Indian Forest Department.

Abstract of the Financial results of the Forest Department in India between the years 1867-68 and 1877-78.

PROVINCES.	1867-68.				1877-78.			
	Receipts	Expenditure.	Surplus.	Deficit	Receipts	Expenditure	Surplus.	Deficit.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Bengal ...	75,687	1,65,605	.....	89,918	4,26,228	2,61,211	1,65,017	.....
North-West Provinces ...	5,11,191	2,89,388	2,21,803	.....	8,00,166	5,23,278	2,77,878	.....
Oudh ...	66,453	93,634	.....	27,181	4,02,962	2,06,947	1,97,005	.....
Punjab ...	2,79,297	2,73,875	5,422	.....	6,83,710	5,17,166	1,66,544	.....
Central Provinces ...	3,49,401	2,12,099	1,37,392	.....	6,83,910	3,17,078	3,66,832	.....
British Burmah ...	6,47,590	3,28,388	3,19,202	.....	16,03,023	8,55,816	7,47,207	.....
Coorg ...	77,746	13,964	63,783	.....	1,01,016	36,267	64,749	.....
Ajmere ...	.....	.....	.....	.....	3,002	14,926	.....	11,924
Assam ...	.....	.....	.....	.....	1,34,326	1,00,287	34,039	.....
Surveys ...	.....	.....	.....	.....	.....	59,708	.....	59,708
			7,47,601	1,7,099			20,18,670	71,632
TOTAL ...	20,07,455	13,76,953	6,30,502	.....	48,38,332	28,91,284	19,47,038	.....
Madras ...	4,24,184	2,88,260	1,35,924	.....	4,04,161	3,82,493	21,671	.....
Bombay and Sind ...	5,94,245	5,47,137	3,37,108	.....	12,61,529	8,66,944	4,04,685	.....
Total (British India)	33,15,884	22,12,350	11,03,534	.....	65,04,015	41,30,721	23,73,294	.....
Mysore ...	4,10,012	1,10,042	2,99,970	.....	4,58,588	1,98,023	2,59,665	.....
Hyderabad ...	53,446	18,341	35,105	.....	2,79,231	1,00,968	1,69,263	.....
Total (Mysore & Hyderabad)	4,63,458	1,28,383	3,35,075	.....	7,37,819	3,08,991	4,28,928	.....
GRAND TOTAL ...	37,79,342	23,40,733	14,38,609	.....	72,41,834	44,39,612	28,02,222	.....

III. REVIEW.

The Journal of Forestry and Estates' Management.

March 1880.—Among the Editorial Notes we are glad to notice a strong protest against the management of the New Forest at home. During 1878-79, this fine forest yielded to the public treasury an income of £53-19-8, or less than one farthing per acre!

We are not among those who are for ever crying out for forests "to pay," irrespective of their state or condition; but this result is simply due to absurd laws, and a want of proper settlement between the rights of 'Commoners' and the rights of the State.

The net cost of keeping up the splendid parks and woods of Windsor was £25,530.

It is also noticed that Professor SARGENT, of Harvard University, has been appointed by the United States Government to prepare a monograph on the forests of this vast territory; he is to take three years about it.

The series of papers opens with another of the "Science for Young Foresters." This number has a tolerable account of soils, but omits some explanations very necessary to the tyro: for instance, no word of explanation is given as to what is meant by "soil" and "sub-soil." The account is followed by a classification of the chief soils of Great Britain, as adapted for various timber growth.

Mr. McCORQUODALE has an interesting paper on the supposed number of *varieties* of the Scotch fir, (*Pinus sylvestris*), which some are disposed to rate as high as thirty. The author contests the reality of the conclusions, and offers some sensible remarks on the known difference between the produce of Scotch seed and that of Continental.

The last part of Dr. BROWN's paper on the *French Forestry Budget* is devoted not to figures, (the main heads of which were indicated in our last), but to a review of the progress in reform in the French Forest laws.

At the end of all is a paper by Professor SARGENT on the Forests of Central Nevada.

The forests contain but seven species—the red cedar (*Juniperus virginiana*), the Californian juniper or cedar, three pines, and only two deciduous trees, an aspen and a *cercocarpus*.

Among the "Chips and Slips" will be found an extract from the *Indian Agriculturist* protesting against the demand for

the Indian forests "to pay." This is so far in the right direction, but at the same time by failing to draw a true line, it misses its purpose. It is quite right of the Government to insist on estates paying, when it is known that they possess a growing stock in such a condition, that if it is only skilfully extracted, prudently disposed of, and really zealous efforts made to find a market for it, good results can be obtained. But it is little short of wicked to demand an income *without discrimination*; to lump up rich forests full of timber in the South, with arid plains crying out for some repose and some plantation expenditure in the North, and to insist on an income for all alike, refusing the most necessary outlay because a cash surplus is not shewn in every year's report.

That is the fault of the Government of India at present; to say nothing of their ignoring the effect that systems of account have, and insisting on comparing one province which credits all to "Forests" with another whose system credits part to "Forest" and part to "Miscellaneous Land Revenue."

April.—The remarks of the Editor on the Study of *Injurious insects* are worthy of perusal. When are "we in India" going to have anything more complete than the small *brochure* (not that we undervalue this as it is) published many years ago by Mr. R. Thompson, and dealing with a few species injurious to forests such as *Xylocopa*?

The "Science for Young Foresters" in this number goes into botany, elementary structure, germination of seeds and so forth; we cannot think this is better done than we could find in the many elementary books and primers which are now everywhere to be found.

A brief paper on the planting in *pits* and by the process called *notching* should be read. Notching and slit planting have been often supposed to be quite inapplicable in the plains of Northern India, but recent experience in the Punjab has shown that this is not the case.

The paper on *Forest Economy* in Sweden should be read; it is "to be continued."

Those who take an interest in the "Future of Epping Forest" will find material for thought in the paper with this title which follows.

May.—We have to congratulate the Editor that he has succeeded in introducing a plea for a Forest School in England, or in Great Britain—a plea which deserves candid attention, *without* making any foolish remarks about India! If only a British School for British foresters were advocated persistently on the many and strong grounds on which it is capable of being urged, without combining the argument with silly and wholly fallacious comments on the *totally different* training required for Indian Foresters, how cordially might all parties join in striving to promote the end in view!

We are glad to see a notice also of the American plan of sending *young plants* of forest trees by mail. We are happy to state that a number of young trees of *Catalpa bignonioides*, sent from America to Lahore *by post*, succeeded admirably.

All Mr. McCORQUODALE's paper are good, and we commend to perusal his discussion in this number on the question whether *prunings*, &c., may be left on the ground to rot, and whether this injures the trees or not. It is a question of no small importance in our hill forests. We can only utilize such length of the bole or stem as we can cut up into beams or sleepers or work into logs for launching for river transport. All tops, branches, chips, &c., &c., must be wasted, as we have rarely any use for them, (except for local fencing) and are often compelled to leave them lying; so also in thinning out "inferior pines" oppressing the valuable *deodar*, &c.

In this number Mr. BARRY continues the discussion about planting in pits or by notches or slits. There is also more about "The future of Epping Forest."

As usual, in the notice of "forest exchanges" all periodicals are mentioned, *except* the "Indian Forester." We should like to know, in the interests of forest literature, why the English Journal never condescends to acknowledge India in any shape, except to put forward statements, which every one, who is cognizant of the facts, knows to be ridiculous, about the training of Foresters at Nancy.

Among the "Chips and Slips" a notice of *Amherstia nobilis* may be read. The writer appears not to know that this beautiful tree, considered sacred by Buddhists, is cultivated in India and in Burma.

There is also a notice of the "South Australia Forest Board." At present nine-tenths of the income is derived from *grazing*.

P.8.—Since writing the above and sending to press we received the *June* number.

Among the Editor's Notes, we are glad to remark the first mention of Indian Forest work, that is written in a kindly spirit without a sneer at our forest officers or an attack on our administration.

It is perfectly true (and though we have before alluded to the subject we make no apology for again noticing it) as the review says, there is far too great pressure now put on the department (to pay.) * This is always the case whenever, as at present, we have the misfortune to find the Secretary to the Government of India, who is the real "first cause" in Forest Administration, opposed to forest interests or to some extent incredulous as to the advantages of any forest administration whatever.

We invite attention also to the method adopted in America, as described in the Editorial Notes, for collecting information about the forest trees of that country.

Plantation officers will read with interest Mr. MACKAY's account of the Glengarry Estate (Invernesshire.)

The paper by an "English Resident" on Forest Economy in Sweden is continued.

Those interested in *Eucalyptus* cultivation will read Mr. TAYLOR's paper, which is really a brief note on *E. amygdalina*, though rather magniloquently called "the Eucalypts of Australia."

Also please read Mr. F. M. WEBB's curious note on "Scotch fir and the ancient forests in the South of Scotland," and a paper on "top dressing the roots of trees."

The Annual Report of the Forest Board of South Australia for 1878-79.

This is the first Annual Report which has been published since a Conservator of Forests was appointed by the Colony, and since a Forest Act, called the "Forest Trees Act, No. 96 of 1878" was passed. It commences with a review by the Forest Board, and then gives *in extenso* the report of the Conservator, Mr. J. E. Brown, who is described on the title page as "Gold Medallist" and "Prize Essayist" of the Scottish Arboricultural and other societies, and who seems to have had considerable forest experience in Canada and the United States.

The Board's review is merely an abstract of the Conservator's Report, but from it we gather the following details:—

The South Australian Financial year ends on the 30th June, a much more convenient arrangement than we have in India, as it allows of the accounts for the the financial and calendar years being easily compared by simply adding together the results of the last six months of one financial year, and the first six months of another, to give the total for the calendar year. Such an arrangement would be a very good one in India where the financial year ends in the middle of a working season, and necessitates the preparation of annual returns during the time when, especially as regards fire protection, much important work is going on.

Without a copy of the "Forest Trees Act" we cannot exactly explain the difference between "Reserves on Schedule B.," "Reserves on Schedule C.," and "Forest Districts on Schedule E.," but it would seem that the first category contains forests whose conservation or replanting is intended, such parts as are not under enclosure for these purposes being leased, usually for a period of 14 years, for pasturage. The second category contains reserves which have been set apart for the accommodation of travelling stock, and the third lands which are available for cultivation leases with the proviso of a certain area being planted up. The first category contains seventy

Reserves with a total area of 229 square miles, while the second category contains twenty-one forests with an area of 145 square miles.

The financial results of the year were :

Revenue	...	...	£4,893-16-2
Expenditure	...	...	£5,501-15-4
			<hr/>
Deficit	...		£607-19-2

but no less than £4,535 out of the whole revenue was on account of pasturage rents, the revenue on timber only being £248.

The Conservator's Report is divided into twelve sections of which the first three treat of the description of forest, the necessity for conservation by the State, and the influence of forest upon climate. The fourth, fifth and seventh give the list of Forest Reserves, the results of the Conservator's visit to them, and then detailed descriptions ; while the rest treat of the rearing of trees for tanning purposes, the best species of tree for conservation and planting, the acclimatization of plants, the training of subordinates, and the results of experiments.

In his account of the indigenous vegetation of South Australia, Mr. Brown states as follows :—

“Of all the territorial divisions of the vast continent of Australia, that of South Australia possesses the least number, and the smallest dimensions of specimens of all genera and species of these, of the ligneous flora indigenous to the country. Not only this, but it is well known that there is less surface, in proportion to its whole area, occupied by forests in this colony, than in any of the sister ones. Here we find vast expanses of country utterly devoid of even the least semblance to arboreous growths, and even where the ground is occupied by trees, these are so ‘scrubby’ in parts, and in others so far apart, one from another, that little or no shade is afforded to the soil.

“Generally speaking, although there are a few ‘very valuable exceptions, the trees indigenous to this colony, do not recommend themselves, as possessing those qualities which we understand are embodied, in what are spoken of, as good timber producing trees. In Australia generally, both the character of the genera, and the quality of the timber produced from the various species of these are somewhat peculiar to this part of the world.”

It would, therefore, seem to us that so far from permitting, as seems to be done, almost unlimited pasturage in the forest, grazing ought to be very carefully managed so as to permit, if possible, of the forests closing up.

As might be expected, the species which are the most important, and form the greatest part of the forest vegetation, are the

Eucalypti and *Acacias*, the former of which produce the principal timbers. As Mr. Brown remarks, however, the species of *Eucalyptus* are not all alike in importance as timber producers; a few of them possess timber of a very valuable quality, while others are so loose in fibre as not even to give good firewood. It would seem that the best timber is given by *E. rostrata*, *E. obliqua* and *E. viminalis*. The *Acacias* or "Wattles" are chiefly valuable for their bark which is so rich in tanning material, the best bark producers being the Golden Wattle (*A. pycnantha*), and Black Wattle (*A. decurrens*). *Acacia Melanoxyylon* is the most valuable for its wood, which is chiefly used in carriage and boat building, and cabinet making. Among other important trees are the native Pines *Frenela robusta* and *F. rhomboidea*, and the species of *Casuarina*. The species herein named are the chief of those which Mr. Brown in his section VIII A recommends for conservation and planting. In that section he remarks on the advisability of not attempting too much in the way of introduction, saying that he considers that success is only likely to be attained with indigenous growth. It is a pity that his opinion is not taken, as will appear presently. Section II is an apology for the State conservation of forest, and the following two paragraphs will be read with interest in India. The first of them sums up in a clear way the necessities for demarcation in those countries which, like many parts of India, are still in process of settlement.

"It is and always has been the experience of every newly-settled country, that in the early days of its occupation, the trees growing upon it were looked upon as "weeds," and thereby a species of hindrance to its subjugation by man. Consequently, we find it was the first aim of the colonists to clear the land of these with as much expedition as possible, without regard to future wants and results. In some countries, notably that of the Northern States of America, where the country was almost entirely covered with trees when the Pilgrim Fathers landed on its shores, this clearing of the land, of the trees upon it, was absolutely necessary in order to the country being made available for agricultural purposes, and therefore able to support a population whose mode of living required the stirring up of the soil for the production of farinaceous food. We find, however, that in doing this, the settlers did not, or would not, and I may safely say, *do not*, draw the very obviously discriminative line between the rate of advantage and disadvantage of the commodity with which they had to deal. Man, therefore, in his haste to make the country available for the supply of his immediate wants, forgot the future of the land of his adoption, and cleared, indiscriminately, the crop which Nature's hands had laid upon it from the earliest stage of the world's history. While, no doubt, as the

greater the extent of country, which became denuded of its crop of timber indicated wealth and material progress, and consequently cause for self-congratulation, so, in the case with most things terrestrial, a reaction came, and when the face of the country became partially denuded of the trees which had been found upon it, when taken from Nature's hands, the civilisers found, to their sad experience, that what was once an evil had now become a necessity. Then, and not till then, when the requirements of a large population necessitated the annual supply of large quantities of timber for commercial and domestic purposes, when the soil would not yield so lavishly as formerly, and when undesirable changes took place in the climate, the prodigal settlers began to undo the work which it had taken years of toil to accomplish, and which might have been avoided by judicious discrimination as the work of reclamation went on. This, we can now see, could easily have been done by the simple plan of retaining, as forest, certain portions of each district of the country in the hands of the governing powers at the time, apart altogether from what, of course, could as easily have been done by individuals in the same way on the parcels of land allotted to each.

"Much, I think, of the indiscriminate clearing which we find in America at the present day, is attributable, to a certain extent, to the fact of the quantity of land granted to each settler being confined to from 100 to 200 acres; as, from the comparatively limited area under his command, it behoves him to have as much of it as possible under cultivation, in order that his holding may yield him a profitable return for the labor expended upon it. With such men, however much they might desire to retain portions of their properties under forest for their own immediate purposes, as their farms came gradually under the plough, and their actions necessarily somewhat circumscribed, any portions of these which might still remain in their original condition, would unquestionably be considered unprofitably occupied. Hence the chance of immediate gain would overcome all considerations for the future. Even at the present day, I have myself found men in America, with limited holdings, who are strong believers in the influence of trees upon climate, and advocate the conservation of existing forests, and the planting of others; who, at the same time, were denuding their properties of every vestige of timber upon them; simply, I say again, from the fact of their operations being somewhat confined. This, I think, is a matter deserving of the attention of the governing powers of all newly-settled countries in the future."

The second para takes a new view of the question of the area to which the partition of land, when in process of being sold or leased by the State in grants for cultivation, should be restricted. Mr. Brown thinks that the alienation of small

areas only is indirectly the cause of denudation, for the planter, or settler is obliged to clear the whole, or nearly the whole of his area, while if he had been permitted to take up a larger extent he would necessarily have preserved a considerable proportion as forest.

But we must say that while acknowledging that the argument is worth considering, it has had a pretty good trial, we believe, in Assam, where the State, for a comparatively small sum, has permitted large areas to fall into the hand of private individuals and firms,* it does not always prove in actual experience so good. Almost in front of us, as we write, lies a large estate, extending from the bottom of a valley, scarcely more elevated than 1,500 feet, up to the crest of a ridge averaging 6,500 feet. This large area is the property of one of the largest tea concerns in the Darjeeling Hills, and a considerable portion, amounting perhaps to one-third, has been placed under tea. The upper zone, of about 1,500 feet vertically, was once, as we can remember, and is still in part, covered with the magnificent forest vegetation characteristic of that altitude in these hills. This forest is one which, under proper management, would amply suffice for all the company's wants in the matter of timber and firewood; and is, in fact, in process, a process which may be best called exhaustive, of working for their annual requirements. We have watched portion after portion of that forest being cleared for the manufacture of charcoal. The system of clearing consists first of all in cutting out all the nice straight growing trees which are likely to give a good quantity of wood, the ancient long-over-mature ones being considered too large at the base, too hollow and too rotten. All the young and half grown timber is also cut, even the very soft wooded kinds whose leaves are used to cover the charcoal kilns. If the trees are at all buttressed, they are cut at a long distance, often eight to ten feet or even more above the ground, so that when the year's supply of charcoal is made, the aspect of the forest is that of a number of unsightly stumps, interspersed with decrepid stag-headed veterans, hollow and rotten to the very top. But were this all, there would still be some hope of reproduction in a climate so favourable to it, and so fertile a soil; but no, then comes the all devouring herd of buffaloes, and no sooner does a miserable seedling shew its leaves above the ground than its future career is suddenly cut short. Block after block has thus been treated with the result that instead of a vigorous reproduction as would naturally ensue, the forest is converted into a dreary waste of strong growing shrubs and chiefly the wild bramble, a growth almost more difficult to penetrate than the neighbouring canebrake. The

* See Dr. Brandis, Report on the Assam Forests, paras 20-21.

case described is by no means an isolated one, the same thing may be seen throughout these hills, partly the result of badly managed private estates, partly, but to a rather less extent, the result of jhum cultivation on government lands kept *khas*. The result is that the unkempt, untidy appearance of the greater part of the country contrasts most unfavourably with the aspect of the lands where native cultivation of small areas is still permitted. It is matter for congratulation therefore, in our opinion, that Mr. Brown's views are not those of the government of the present day, and that the time when large areas were indiscriminately alienated is now past and a better state of things inaugurated, at any rate in Bengal, by the new Tea Lease Rules.

After discussing the question of the stoppage of indiscriminate clearing, and the necessity for the State administration of forests, Mr. Brown describes the present condition of the South Australian demand.

This demand consists :—

- (1.) Of timber for mining,
- (2.) Of building timber,
- (3.) Of fencing materials,
- (4.) Of timber for railway purposes,
- (5.) Of firewood,
- (6.) Of wood for manufactures,

and would, from Mr. Brown's account, seem likely to be eventually considerable, though now evidently small, the present systems of working being, especially in the case of fencing materials, most wasteful.

We pass over Mr. Brown's chapter on the influence of forests, and proceed to that on the reserves. These reserves, as already stated, consist of about 374 square miles, situated chiefly in the Northern and Southern District. The principal of these reserves are Bundaleer 22,000 acres, Wirrabara 43,320 acres, and Woolundunga 19,200 acres. We have gone through the detailed descriptions of these reserves with interest not unmixed with regret that they should not be treated from a much broader point of view. They all seem to be thinly stocked, to be urgently in need of rest and reproduction, but yet even the Conservator looks upon grazing as the principal source of revenue, and talks, rather inconsistently after his other statements, of replanting by small areas at a time, with such trees as *Araucaria excelsa* and English Ash and Walnut. Would it not be better to extend demarcation—374 square miles is not a very large area for a rising colony to preserve as forest—to attempt to restrict the grazing, at any rate to certain blocks, allowing the rest a chance of reproduction; and to work out all the old felled timber which would seem to be so common, before new trees are touched?

The remainder of the report is chiefly taken up with a list of exotic trees to be introduced, which we need not refer to

except to say that this introduction seems to us to be beginning at the wrong end. It then proceeds to the important point of the training of rangers and Nurserymen, and here we quote Mr. Brown's proposals:—

“(a.) That three or four young men be engaged with the view of their filling, at some time, the positions referred to.

“(b.) These to be above twenty and under thirty years of age.

“(c.) They must be able to read and write intelligently, have a knowledge of book-keeping, and have had experience in a nursery, either in the colonies or at home, in the sowing of seeds and transplanting of young trees.

“(d.) That they be sent to the reserves, which are at present in working order, and employed on these, under the nurserymen, in the same way, and at the same rate of wages, as the ordinary laboring class.

“(e.) That instructions be given to the nurserymen, under whose charge they may be at the time, to afford them every opportunity of making themselves acquainted with every particular connected with the working of the various operations on the reserve.

“(f.) In order that they may become thoroughly versed in forest administration and its application to the different localities of the colony, they would be changed from one reserve to another, and thus be educating them in the great principles of cause and effect, and the influence of local peculiarities on the growth of trees.

“(g.) That, if not already versed in such matters, they should, at every opportunity, and by the use of books, make themselves acquainted with the following subjects:—

- (1.) Land surveying and mensuration.
- (2.) Botany and vegetable physiology.
- (3.) The chemical ingredients of soils.
- (4.) Entomology in its application to those insects destructive to trees.

“(h.) During the periods of the Conservator's visits to the reserves, he would examine them in the sciences named, and besides, would take them with him, when examining the various works, and by questions and explanations store their minds with every detail of these, and thus prepare them to carry out such work themselves when they come to have charge of a reserve.

“(i.) They would be engaged on the distinct understanding that, if upon trial they were found unsuitable to fill the positions which they were intended to occupy, or if circumstances arose which would prevent the Board from being able to appoint them to such positions, they would be discharged without any compensation whatever.

“(j.) When appointed as Forest Rangers they would receive £160 per annum; a forage allowance of £52, and a free house.

These proposals only bear out what we have often said with regard to the question so persistently advocated by the 'Journal of Forestry' and some of the Scotch societies, of the greater employment of Scotch Foresters in India and the Colonies, that the narrow minded views likely to be taken by that class, admirable as they are for the management of the few acres of highly cultivated land which form the forests of Scotland, are not those which are best suited to the wants of the large government forests of a country, nor the best calculated to ensure a broad and comprehensive system of working, that, while securing a good return to government, shall yet tend to gradual improvement and economy.

We have already, in a former volume, noticed that we thought that South Australia was beginning at the wrong end in making all these scattered plantations of exotic trees instead of first considering the far more important questions of demarcation, protection, and natural reproduction.

But in a case like that of South Australia, any beginning is better than none, and although we cannot agree with his views, we think the Conservator is evidently much interested in his work and anxious to improve the condition of the forests.

Review of Forest Administration during 1878-79, by Dr. Brandis, Inspector-General of Forests.

Budget Estimates of the Forest Department for 1880-81.

THE general review has appeared considerably earlier than usual, and indeed, had space admitted, it might have been reviewed in our last number. The review commences with a short *resumé* of the progress of professional education for the Department up to the establishment of the Dehra Dún Forest School, which event is justly characterised as the most important of the year.

The description of the system of selection of candidates for the school, and the course of training to be gone through is there dealt with, and we need offer but few remarks upon these points. We hope, however, that as the school developes, the present rather complicated system of appointment to the school by Local Governments, subject to the chance of there being sufficient savings, which does not always happen, in the grant allotted for them to subordinate forest establishment, will be altered, and a more general plan adopted by which the courses of the forest school shall be open to candidates in the same way as the courses at Roorkee, Poona or at the new Calcutta Engineering College now are for natives of India who desire to enter

the subordinate posts of the Public Works Department. It would almost be a better plan to deduct annually a certain small sum from the provincial establishment allotment, and add it to the budget of the forest school, leaving the whole of the work of selection and training to the Director, who could be applied to by Conservators, as vacancies occur in their circles, for trained men to fill them. This would, to some extent, obviate the difficulty of selection and the provision of funds, and more particularly do away with the natural reluctance which Conservators must have in parting with the services of often their best rangers for two years, while these rangers are being taught, no immediate benefit accruing to the province from the money spent in their pay and education. The advantages of the forest school are so great that it is quite worth while that some attempt should be made to make its entry easier; and we certainly think that volunteer students, who can comply with the conditions, should be allowed, in direct communication with the Director, to prosecute their studies without being specially deputed by one province or another.

The total area of reserved forests is less than in former years. This is due to the whole of the forests declared under previous rules not having been so declared under section 34 of the Act. Many of these forests are, however, only temporarily omitted as some further procedure in the definition of rights and settlement of boundaries was required before they could be finally gazetted under the new Act.

The account of the operations of fire conservancy are more than ordinarily interesting, as the season of 1878-79 was one of the driest of late years in almost all provinces. In Bengal the fires extended far into the hills, and to great elevations, through forests which, in ordinary seasons, are much too damp to burn, and the damage done in the Terai was very great. Parts of the Duars Forests were happily saved, as well as the plantations in the Terai. In the North-Western Provinces and Oudh the results are said to be most unfavourable, and the following extract from Captain Wood's report shews the damage done in the Dudua home block which had previously enjoyed seven years of continued protection:—

“Several fires were communicated to the Dudua home block about January and February from the fires of graziers outside the block; these, even in the cold weather, were extremely difficult to put out, owing to the mass of dry vegetation in the long grass. In May 1879, when a strong hot wind was blowing, one of the fire conservancy watchers in the south block, alluded to in paragraph 32 of last year's report, set his razai on fire from a spark, and, to save the hut he was in, threw the razai outside; the sparks caught the high grass near, and the fire spread with fearful rapidity, setting fire to the grass on the other side of the Subeli in the lower sisau closed block. The bed of the Subeli here is over 100 feet in width, only sand and water, without a blade of grass on it. All attempts were in vain to stop the fire, and I regret to state that the whole of the lower closed block was burnt, and all but 5 square miles of the Dudua

home block was burnt over. The improvement fellings were fortunately saved. This is a great loss, but the benefit derived from the closing has not been entirely lost, many young trees having come up and being still on the ground that would not have come up without conservancy, and in natural forests, the soil growing thickly in clumps. Where the young trees were close together and the grass killed down, the injury has been much less than where the young trees were scattered. This fire communicating with grass over a clear space of over 100 feet, shows that the wind carried lighted grass far over that distance."

In the Punjab fires were very bad, while in the Central Provinces, Berar and Coorg, fire protection was much more successful.

In the chapter on plantations the most noticeable point is the question of *coal* versus *wood* as fuel, chiefly with reference to the supply from Changa Manga Plantation. On this subject paragraphs 49 and 50 say :—

The annual thinning in Changa Manga and in the Sailaba plantations near Lahore have now become very extensive. Thus, the thinning in 1878-79 yielded 686,343 cubic feet of stacked wood, in addition to 202,959 cubic feet remaining on hand from the previous year. These plantations have thus commenced to yield a very considerable annual supply of fuel, and this supply will eventually be a matter of some importance, for it is by no means certain that the Punjab Northern State Railway will not find it an advantage to use fuel instead of coal, and if this is the case, it seems not unreasonable to expect that eventually some of the wood produced on these plantations may be consumed by the Punjab Northern State Railway, unless other customers can afford to pay higher rates. These plantations are chiefly stocked with *sissu*, and their ultimate annual yield, after they have attained maturity, is estimated to be very considerable.

Coal, as locomotive fuel, has certain advantages over wood, which will often make Railway officers incline to prefer its use, although the cost of coal may be greater. Nevertheless, the question of wood consumption on the Punjab Northern State Railway is mainly one of cost. It has been calculated that on the Punjab Northern State Railway, with coal at Rs. 31-8 per ton in Lahore, and with wood at Rs. 30 per 100 maunds, the cost of coal per train mile was 6-9 annas as against 5-12 annas cost of wood, and that the small difference in favour of wood is counterbalanced by savings in establishments, lessened loss by risk of fires, lessened detention of trains at wood depôts, and other circumstances. The result of this and of the increasing difficulty in procuring wood has been that, while in the half-year ending the 30th June 1878, 1,549 tons of coal were used as against 1,844 tons of wood, the consumption in the corresponding half-year of 1879 was 3,427 tons of coal as against 1,698 tons of wood, yet coal is now costing the Government Rs. 34 a ton on the Punjab Northern State Railway.

The question of extending these plantations, or of establishing new plantations north of Lahore, must, to a great extent, depend upon the rates at which the wood produced on such plantations can be delivered at the principal stations of the Northern State Railway, and upon the cost of coal at those stations. It may safely be assumed that the price of Bengal coal at the pit's mouth will not materially increase at present, and as regards the cost of wood, 2 pies per ton per mile may be taken as the rate chargeable for haulage to the place of consumption. Again the price of wood per ton should not exceed one-third of what Bengal coal would cost at the place of consumption.

The extension of the system of teak planting as *Toungyas* in Burma is noticeable, as is also the failure of the *Ficus elastica* to

thrive at Magayee. This is attributed partly to its having been planted under shade, partly to the long and hot dry season of Pegu not being favourable to its growth.

The financial results of the season 1878-79 may be given as follows :—

		Revenue.	Expenditure.	Surplus.
Government of India...	...	42,24,881	30,18,044	12,05,987
Ditto of Madras	...	3,83,878	3,43,789	40,089
Ditto of Bombay	...	11,81,898	9,99,161	1,82,732
Mysore	...	4,52,575	1,98,020	2,54,555
Hyderabad	...	2,85,670	1,07,350	1,78,320
Total Rs.	...	65,28,897	46,67,264	18,61,633

showing a considerable decrease both in gross and net revenue in 1877-78, and a slight increase in expenditure.

The review goes into careful analysis of the figures of this and former years which shew a decrease in revenue, chiefly in the Punjab, but also in the North-Western Provinces and in Burma, while the revenue in Bengal, Assam, and the Central Provinces is steadily increasing. After giving a short account of forest work in the Bombay Presidency, the review concludes with the admonition to forest officers that *revenue* and the rational working of the forests is to be the programme for the next five years.

There is little to be noted regarding the Budget Estimates for 1880-81, the following being the figures accepted :—

		Revenue.	Expenditure.	Surplus.
Government of India ...	...	48,54,000	36,02,000	12,52,000
Ditto of Madras	...	4,24,000	4,17,000	7,000
Ditto of Bombay	...	13,77,000	10,52,000	3,25,000
Hyderabad	...	2,90,000	1,25,000	1,65,000
Total Rs.	...	69,45,000	51,96,000	17,49,000

Mysore has been, we see, omitted.

The resolution of Government then finishes up with a similar admonition to that to which we have referred to in the review by the Inspector-General.

IV. NOTES, QUERIES AND EXTRACTS.

PRUNING FOREST TREES.—Great difference of opinion prevails as to the necessity for pruning forest trees and the season at which such operations should be carried out. But undoubtedly the weight of authority is favourable to early summer pruning. The month of June is strongly recommended, because at that time the wounds heal up much quicker than during July or August, when the motion of the sap becomes slower. And it should be a standing rule with the pruner that no wound remain exposed to the action of the atmosphere for a longer period than one year. If the aim of the owner of woodlands was confined to the production of the greatest amount of wood upon a given area in the shortest possible time, it is questionable whether pruning of any kind should be executed; for every branch cut away from a tree lessens the quantity of foliage presented to the action of the sun and the atmosphere, and therefore decreases the absorption of carbonic acid gas and the formation of wood, of which carbon is the main constituent. But where the object in view is the growth of the maximum of straight, lengthy, clean, and sound timber, thinning and pruning must commence soon after planting, and continue until the trees attain considerable proportions. By thick planting, early thinning, and careful stopping of rambling shoots or rival leaders, pruning will seldom be necessary except in the removal of injured branches. But as the growth of a tree is slow, and he who plants seldom lives to train up his trees to maturity, pruning in an advanced stage of their growth is often necessary in order to lessen the evils resulting from early neglect.

Trees differ so much in habit and in their rapidity of growth, and are so largely dependent upon the soil and situation in which they are placed, that it is impossible to lay down any precise rules for their management in this respect. Those intended to form large and good timber should never at any stage of their growth be suffered to become too much crowded, nor overtopped or whipped by their nurses; and as they rise they should be allowed sufficient space to enable them to develop well-proportioned heads, equal in length to from one-third to one-half the height of the entire tree. It should also be borne in mind that by preserving a complete canopy of foliage overhead the moisture is retained in the soil, the stems rise rapidly and the formation of side branches is retained.

The advantages of early pruning are nowhere more observable than in young plantations of Oak and Spanish Chestnut. Two years after planting it is no uncommon occurrence to find a considerable number of the young trees hide-bound and becoming distorted in their growth. Such, if left to themselves, seldom or never attain to the size of timber trees. But if cut over with a clean section within two inches of the ground, they will push forward vigorously during the following spring and summer. By rubbing off all but two of the strongest shoots in June or July, and allowing these to grow on together until the following March, and then cutting out the weaker of the two, and afterwards keeping the other single upon the stub, a vigorous growth may be insured, which will, in a few years, far exceed that of the uncut trees. A most remarkable instance of this is mentioned by Forsyth, who, the second year after planting a bed of Oaks, headed down one-half and left the other to grow naturally. In giving an account of their progress a few years afterwards, he states that one of the plants thus cut over was 18 feet high and 15 inches in circumference at 6 inches from the ground, while the largest of the uncut ones was only 5½ feet high and about 4 inches in circumference.

But, while recommending the early and careful pruning of forest trees, I would not be considered as an advocate of the excessive lopping and pruning introduced by Pontey, and so ruthlessly carried on by his successors, who looked upon and spoke of the branches of trees as being merely "robbers of the stems." To produce lengthy timber every branch which threatens to rival the leader should be shortened. By adopting this method instead of cutting away the branch entirely the trunk is strengthened by the sap being detained in its descent. Timely attention will obviate the necessity for heavy prunings at any stage of a tree's growth. The pruner should, however, be conversant with vegetable physiology, otherwise that twilight of uncertainty, in which all his operations are performed, may lead him to commit grave errors. In close plantations the destruction of the lower branches is eventually caused by the exclusion of light, but the result is generally unsoundness of stem. This is found to be the case so extensively in Canada and other large timber-producing countries, that a very small proportion of the trees grown under such circumstances are fit for exportation.

The whole art of pruning and training timber centres is the adoption of a proper mean between the two extremes of cutting away the branches of a tree so as to give it the appearance of a mere May-pole in the one case, and that of a dense spreading bush in the other. A severe mutilation of the head of any tree must for a long time paralyse the action of its roots, and on this account the heavy pruning of neglected trees, if undertaken at all, should be extended over two or three seasons.

Deciduous trees will require the most careful training in order to produce sound timber. As considerable difficulty is experienced in pruning trees of a resinous kind without injury to their growth, it becomes the more necessary to plant and rear them in close order. The lower branches under these circumstances are soon killed back, and may be removed so that the longitudinal structure of the bole is but little injured, as, by the early destruction of the laterals, the superincumbent layers of wood are entirely free from knots. Thus it happens that Fir timber grown in close plantations, where the early removal of the dead, bolt-like insertions left by the dead branches is attended to, becomes the most valuable, while single trees, from their coarseness of grain and abundance of large knots, are almost worthless to the builder. It is also found that Ash grown in close plantations becomes much tougher and clearer in the grain.

In exposed situations both the pruning and the thinning of trees should be much lighter around those margins of plantations which face the prevailing high winds of the district. By too close packing it often happens that only the face of the very outermost trees are clothed with foliage, so that any injury to one of these admits the destructive winds. This may be guarded against by a judicious early thinning of such margins, so as to secure a belt of low-branched trees.—(A. J. BURROWS, in 'The Garden.')

SOME short time ago samples of the gums or rather guttapercha given by three of the Indian Figs (*F. indica*, *F. religiosa* and *F. glomerata*) were sent to England for report on their value. The following is an extract from a letter from Mr. Matthew Gray, General Manufacturer, India Rubber, Guttapercha, and Telegraph Works Company:—

"We have received your letter of the 31st ultimo, and have examined the three samples of dried *Ficus* milk which you sent to us. We have no doubt they are all of some commercial value if properly collected and carefully dried. The samples were too small for us to form any correct opinion of their commercial value, and we would feel much obliged to you if you could get sent to us about 100lbs. of each of the three sorts, that will enable us to test in some practical manner their value.

It is of the greatest importance in collecting the milk and drying it, that it be done with care and in a proper manner, so that it be kept clean and no decomposition take place in the drying. To do this, it is necessary that the drying be done under a roof supported by poles, to screen the milk from the direct rays of the sun. Trays for drying the milk should be made of common deal timber, say three feet long and eighteen inches wide, with side and ends about three inches high; these trays are put upon supports below the roof, and into them is

poured the milk about one-eighth of an inch deep; this is allowed to remain until it is dry or nearly dry, when another layer of milk is put on top about one-eighth of an inch in depth, which is allowed to dry. This process is repeated until a cake of two or three inches in thickness is made up, when it can be turned out of the tray in a dry cake of firm dry gum, three feet long, eighteen inches broad, and two or three inches thick. This care in the drying of the gum may appear unnecessary to those who collect it, but years of experience has proved to us the necessity of doing it as we describe; we have found that if it is dried with the direct rays of the sun bearing upon it, decomposition takes place, or if dried in too thick a mass the outside of the mass gets dry and firm, while the centre contains moisture and induces decomposition, thereby injuring the quality of the gum very much."

THE AMERICAN YELLOW CEDAR OR CYPRESS.—An American paper states that this noble tree sometimes attains a height of 150 feet, and a diameter of from three to five feet. The branches are pinnate, drooping, feathery, dividing into beautiful light-green sprays, like those of the California *Libocedrus*, but with finer foliage and more delicate plumes. The wood of this tree is undoubtedly the best the country affords, and one of the most valuable to be found on the whole Pacific coast. It is pale yellow, close-grained, tough, durable, and takes a good polish; and to these qualities is added a pleasant fragrance, like that of sandalwood.

The only California wood that resembles this is the torrega, which has the same delicate yellow colour and close texture, but the pleasant scent is wanting, while the trees are small and scattered in and out of the canyons. Some three or four ships have been built of yellow cedar, and small quantities, a few thousand feet at a time, have been sent to Portland and San Francisco from Sitka, Fort Wrangel, Checan, and Port Simpson, probably less than a million feet in all. Some little goes to China, and is made into fancy boxes, it is said, to be returned to us for camphor-wood. It deserves to be far better known, not only to shipbuilders, but to carpenters and furniture-makers. The Indians make their paddles of it, and weave matting and coarse cloth from the inner bark of the tree, which is quite durable, and of a fine brown colour. It is also the favourite firewood of the coast region, burning very freely; though it does not last long. A yellow cedar fire, to any one witnessing it for the first time, is quite a notable phenomenon. The flames quiver and rush up in a multitude of ragged-edged lances, while the burning surfaces snap and crackle and explode, and throw out a shower of glowing coals with such a noise that conversation in an ordinary pitch of voice is at times

impossible. Every open hearth in which this wood is burned, has to be closely screened with a framework of wire netting, else the floor would be strewn with cinders. The durability of this timber is forcibly illustrated by the fallen trunks lying in the damp woods. Many of the largest of them last for centuries, retaining even the delicate colour and fragrance unimpaired. Soon after they fall they are overgrown with moss, in which seeds lodge and germinate, and grow up into vigorous saplings, standing all in a row on the backs of their ancestors. As they grow larger they stand astride, sending their roots down and out on both sides, like the straddling legs of a spider. And, after they have reached an age of several hundred years, the downtrodden trunk, when cut into, will almost always be found as fresh in the heart as it was when it fell. Decay goes slowly on from the outside, never commencing in the heart-wood, as far as I have noticed, though a good many of the living trees are injured by a fungus which produces a dry rot similar to that found in *Thuja* and *Libocedrus*. The species is found as far south as Vancouver Island, and is pretty generally distributed along the coast and through the islands, as far north as Sitka,—how much farther in either direction I am unable to say. But though its range is thus extensive, it does not seem to be very abundant in any one place, or to occupy any considerable area to the exclusion of other species.—*Timber Trades Journal*.

FORESTS OF THE CAUCASUS.—Reporting on the trade and commerce of the Caucasian Provinces, Acting-Consul Lyall, after referring to the immense extent of forest-covered area existing in the Caucasus, points to the fact of their being of little or no commercial value. He says, wherever means of transport to a market exists, either by rafting down a river or the vicinity of the seaboard, the forests have either been already denuded of good trees, or exorbitant prices are demanded for the right to fell. The mountains round Tiflis have, for many years, been completely cleared even of brushwood, and firewood is in consequence very dear. The practice of denuding the mountains, which goes on throughout the Valley of the Kour, has resulted in either completely drying up, or diminishing seriously, the volume of water in the rivers. It may be expected, unless measures are taken for re-forestation of the mountains, or some scientific methods of irrigation introduced, that famines will before long take place. The Government of the Caucasus have long had a complete reorganization of the existing Forest Department under consideration, but this reform, like many others just as urgently required, has hitherto been postponed *sine die*.—*Ibid*.

A LOG RAILROAD.—The log tramway or railroad in use by the Richardson Brothers at their mill, south of Truckee, is a very ingenious piece of machinery. Logs ten inches or a foot in diameter are hewn round and smooth, and their ends are coupled together by iron bands. These logs, laid side by side upon graded ground for a distance of perhaps three miles from the track. Of course the road looks quite like an ordinary railroad track, except that logs are used instead of rails, and the ties are at much greater intervals. The wheels of the engine and cars are concave on their outer surface, and fit the curve of the logs. The power is applied to a wheel in the middle of the forward axle of the engine. The most remarkable loads of logs are hauled upon the cars, and the affair is a decided success. It is very cheap, its construction is simple, it is not easily damaged, and its operation is all that could be desired. By means of this log railroad the Richardson Brothers are enabled to get their logs to the mill from the forest, three miles distant, at a cost far less than is ordinarily done.—*Truckee Republican.*—*I bid.*

FOREST FIRES.—Thousands of acres of wild and cultivated lands have been devastated recently by extensive forest fires in New Jersey, Pennsylvania, and Virginia. The country about Tuckerton and Tom's River and Forked River, New Jersey, has been swept over by the flames, and cranberry bogs, strawberry farms, timber, dwellings, barns, and live stock destroyed. The well-known shooting grounds in that region have been utterly destroyed. The singed bodies of thousands of quail and other game birds, and rabbits, have been found on the outskirts of the burned districts. Immense quantities of game have also been destroyed in Monroe and Pike counties, in Pennsylvania. Warm, dry, and windy weather has prevailed in Virginia for several weeks past, and these forest fires there are reported unprecedented in extent and damage. The fires in the dismal swamp have been raging for more than a week. They envelop the whole of Lake Drummond. The cultivated sections of the adjoining country are overrun with bears, panthers, deer, and smaller game. A Reuter's telegram, dated New York May 13th, says:—Fires have broken out in the forests in the south of New Jersey, and in the oil regions of Pennsylvania. The conflagration is spreading, and causes immense destruction of oil and agricultural property. Several small villages have been destroyed by the flames.—*I bid.*

PRESERVING WOOD.—The improved French method of preserving wood by the application of lime is found to work well. The plan is to pile the planks in a tank, and to put over all a layer of quicklime, which is gradually slacked with water.

Timber for mines requires about a week to be thoroughly impregnated, and other timber more or less time according to its thickness. The material acquires remarkable consistence and hardness, it is stated, on being subjected to this simple process, and the assertion is made that it will never rot. Beechwood, prepared in this way for hammers and other tools for ironwork, is found to acquire the hardness of oak without parting with any of its well-known elasticity or toughness, and it also lasts longer.—*Ibid.*

ARIZONA SHELLAC.—At a recent meeting of the California Academy of Sciences, Professor Stillman read a paper on the gum and colouring matter found on the *Acacia Greggii* and *Larrea Mexicana*, or creosote plant. The gum which exudes from these plants is very abundant, and is the product known to commerce as shellac. The same plants produce lac dye. Professor Stillman suggested that California might compete with British India in supplying this valuable product. Mr. B. B. Redding said that these lac-yielding plants were as plentiful as sagebrush, from Southern Utah to New Mexico, and from the Colorado Desert to Western Texas.

The lac is most abundant around stations on the Mojave and Colorado deserts, and exudes as the result of an insect's sting. Calcutta exports a million pounds sterling in value, annually, of shellac, selling at 25 to 35 cents a pound; and almost as much more of lac-dye, selling at 30 to 40 cents a pound. In 1876, the United States imported 700,000 pounds of shellac alone. To collect this is simple work for boys, and will prove an important industry. It will require little or no capital. The twigs are boiled in hot water, and the gum rises to the top, is skimmed off, strained, and dried on smooth stones, and handpressed into flakes, ready to make sealing-wax or varnish. The residue, when allowed to settle, makes lac-dye. The plants live on a rainfall of three inches a year.

In Vol. VI (Botany) of the reports of the U. S. Geographical Surveys, west of the 100th meridian, we find the following information relative to these two plants which would seem to be worthy the attention of commercial men and manufacturers, page 108—*Acacia Greggii*, Gray.—A small tree, 10 to 20 feet high, pubescent or glabrous, unarmed or with scattered, stout recurved prickles; pinnae 2 or 3 pairs, on a slender petiole; leaflets 4 or 5 pairs, oblong or oblong-ovate, 2 or 3 lines long, rounded or truncate above, narrower at base, rather thick, and with 2 or 3 straight nerves; flowers in cylindrical spikes an inch or two long, the peduncles equalling or exceeding the leaves; pods thin, coriaceous, flat, 3 or 4 inches long by 5 to 7 lines broad, shortly stipulate, acute, curved, glabrous, and reticulated, more or less constricted between the seeds;

seeds half an inch long. From Western Texas to Southern California; collected in Western Arizona, 1872.

Page 41—*Larrea Mexicana*, Moricand, *Creosote bush*.—Common from Western Texas to Kern County, California, and southward to Mexico. Dr. Loew's examination proves that the reddish brown exudation on the branches, caused by an insect, will yield a red coloring matter showing all the reactions of cochineal. "The alcoholic extract of the leaves, on evaporation, yields a greenish brown residue of a specific and somewhat disagreeable odour, more strongly perceptible on boiling the extract with water. This residue is only, to a small extent, soluble in water, and the solution has an acid reaction. It yields a light yellow precipitate with acetate of lead. The part of the alcoholic extract, that is insoluble in water, is easily soluble in alkalies. It also dissolves in nitric acid at a moderate heat, whereby exudation takes place. On addition of water a yellow brittle mass is precipitated." The Mexicans are said to use an infusion of the leaves for bathing in with good effect in rheumatic affections. (Also Vol. III, Wheeler's Reports.)

Page 80—*Larrea Mexicana*, Moric. (*L. glutinosa*, Engelmann),—Valley of the Gila, Arizona. This shrub is especially common on the hills bordering the Gila, also on the sandy wastes adjacent to Tucson and Camp Lowell, in Arizona, even imparting its strong odour to the air.

In the third volume of these reports this plant is also called stinkweed.—*Scientific American*.

In a recent number of the *Asian*, in a kind notice of our Journal, the reviewer, referring to our note on the subject of toughened glass for sleepers, refers us to *The Month*, in a late number of *Chambers' Journal*, where it is stated that "where glass sleepers have been laid by way of experiment they stand wear and tear as well as iron, perhaps better, for they do not corrode." On the same subject we now extract from the *Timber Trades Journal* as follows:—

"TOUGHENED GLASS SLEEPERS.—In regard to this subject the New York *Manufacturer and Builder* says:—We feel inclined to express our lack of confidence in the practical application of this material for railroad sleepers. The advantages of wooden sleepers are, that railroad spikes are easily driven into them; but how about making reliable fastenings of the rails to glass? And how about tightening when a rail becomes loose? Then wood possesses an elasticity which is not only very desirable as a seat for the rails, but necessary. On the first experimental elevated railroad in Greenwich-street, this city, the rails were fastened directly upon the large T pieces which crowned the columns supporting the road; a great improvement was effected by putting wooden sleepers across on top of these rails, and then other rails on top of these sleepers; and this is essentially the principle upon which now all the New York elevated railroads are constructed. Another example occurs to our mind. Some forty years

ago the Camden and Amboy Railroad, between New York and Philadelphia, was built on stone sleepers. It was supposed that as stone was so much superior to wood in solidity and durability, it would be a great advantage, not only in strength, but also in cost of repair. These stone sleepers and piers were all removed thirty years ago and wooden sleepers substituted, and we do not see why glass would have any advantage over stone. The stone referred to was granite, some varieties of which are about as strong as the toughened glass referred to."

WE have received the Report for 1878-79 of the Ootacamund Botanical Garden, which presents but little of forest interest. It is stated that the *Araucaria* (*A. Bidwilli*) thrives admirably on the Nilgiris, one specimen, only twelve years old, having reached a height of over 28 feet. Mahogany, too, seems to be doing well, though we should certainly have thought that the attitude would be too great for it.

The success of the Cocoa plant in the Nilgiris, as well as of Liberian coffee, seems to be the chief point of interest in this report. The former seems to have been most successful, while the growth of the latter seems to be very fast and healthy.

A NEW variety of the Cedar has been discovered in Cyprus. It was, we believe, first brought to notice by Sir Samuel Baker. It is very uncommon, being found in only one locality in the mountains. In character it is said to resemble more nearly the Atlas Cedar than the Cedar of Lebanon or the Deodar.

IN an article in the *Asian*, to which we have already referred, it seems to be supposed that the translation of an Italian paper on the Carob tree by Mr. Duthie, which appeared in our last number, was taken from the journal of the Agri-Horticultural Society. This, too, the Society seem to think, for we have received letters from their Secretary requesting us to "acknowledge that the paper was taken from their journal." However, we are afraid the Society will not get any such acknowledgment this time, the fact being that the paper was placed in our hands in manuscript last January, only just too late for the January number and possibly as soon as it was received by the Society. At the time we sent the paper to press, we were unaware of the Society's also having published it, or we should probably have left them the whole of the honor and glory of producing our friend Mr. Duthie's interesting translation.

ON the 9th May last, at three o'clock in the afternoon, a fire broke out in the Forest of Fontainebleau in the part known as the *Gorges d'Aspremont*. The fire which, it seems probable, was due to the carelessness of a smoker, spread

rapidly in the dry grass and among some young maritime pieces which had been killed by the winter frosts. The damage done was estimated at 3,000 francs, and the area burnt over was about 10 hectares. It was extinguished in the evening with the assistance of passers-by and a detachment of the 11th Hussars.—*Revue des Eaux et Forêts*.

THE FOREST ACT IN BOMBAY.—The *Bombay Gazette* regrets to learn that since Sir Richard Temple's departure there has been an attempt to reverse, at least to modify to a considerable extent, that forest policy which he so successfully, and in the face of great official opposition, introduced into the Presidency. Believing, as this paper does, that upon the proper protection of forests, and on the re-clothing of the denuded hills of the Deccan with vegetation, depends in no small degree the future prosperity of this country, the reversal of the lately inaugurated forest system would in its opinion be a national calamity. After quoting in support of the policy of the Act the example of the efforts now being made by the Americans to reafforests their country the article continues: "it is asserted that the application of the Forest Act entails very great hardship on the people. We believe the reports of these hardships to be very greatly exaggerated. The Act provides that no ground shall be taken over unless all claims have first been settled. Is it seriously maintained that this provision is inoperative? If claims on the waste taken over be once settled, a villager chooses to enter a Government plantation and to cut down young trees, he deserves no sympathy if he is punished. Moreover, the intention of the Act is not to stop the consumption of timber, but simply to regulate it and to provide for the replacement of whatever is cut down. If the villagers were allowed to have their own way, there would soon be not a tree in the country. So for their own good, and above all for the good—even the safety—of the millions who have as much right to these forests as the few villagers who live near them, the provisions of the Forest Act must be carried out. It is also said that conservation of waste lands means a diminution in the supply of forage. That is not the case; on the contrary, land that is conserved yields ten times more forage than bare tracts exposed to the scorching sun, and from which the earth is year by year being wasted away. All that the Forest Act requires is, that the people shall desist from sending their goats and sheep into conserved tracts until the trees are strong enough to be left to themselves. We sincerely hope that the Governor and his more immediate advisers will not be led away by clamour, but will steadily carry out the policy of reafforesting the wastes which it was the proudest achievement of his predecessor to lay down."—*Pioneer*.

Y. THE TIMBER MARKET.

Messrs. CHURCHILL & SIM will, on May 25th at the Baltic sale room, offer the following:—a fine entire parcel of Honduras wood, a parcel of city wood curls, cedar, American black walnut, Kawrie pine planks, camphor wood, birds'-eye maple, rosewood and fustic; also a varied assortment of East India furniture hardwoods, the latter to be sold without reserve by order of the Conservator of Forests, North-West Provinces, for the purpose of introducing these woods to the home trade, consisting of native mulberry, maple, walnut, chestnut, oak, kara, sissou, olive, and boxwood.—(*Timber Trades Journal*.)

THE TEAK MARKET.—Messrs. Bulloch Bros., in their Rangoon market report, dated April 22nd, 1880, say that little business, has been done in timber for Europe, and the market closes quiet. The quotation remains at £8 2s. 6d. per ton of 50 cubic feet. The export of teak from April 8th to 21st to Europe was 152 tons, making a total of 733 tons since January 1st last, against 2,258 tons during the same period last year. In their Moulmein market report, dated 15th April, the same firm state that the demand for what teak is available is still very keen, and one of the principal shippers is reported to have made a purchase of 2,000 logs at a very high figure. The export of teak from 2nd to 5th April to Europe was 955 tons, making a total of 9,475 tons since 1st January, against 1,334 tons during the same period last year.—(*Id.*)

On May 25th Messrs. Churchill & Sim offered for sale at the Baltic a varied assortment of furniture and fancy woods. The following are the prices realized:—

298 logs Honduras mahogany from St. Thomas, sold at 4½d. to 9½d.; average 5¾d.

37 logs ditto cedar, ditto, at 4½d. to 5½d.; average 4¾d.

The black walnut from New York, went off briskly at 4s. to 5s. 8d. per foot cube.

10 planks Kawrie pine at 2s. 9d. per foot cube.

40 logs Honduras rosewood were bought in at £5 per ton.

The samples of East India fancy woods, to which we alluded last week, were all sold at prices noted below. These woods were sent from the Tons division of the North-west Provinces of India, and shipped at Calcutta by order of the

Conservator of Forests, North-west Provinces, with the object of introducing them to the home markets.

- 3 logs mulberry wood (6 c. f.), at 4s. 3d. per c. f.
- 3 „ maple (5 $\frac{7}{8}$ c. f.), at 1s. 3d. „
- 3 „ walnutwood (8 $\frac{3}{8}$ c. f.), at 4s. „
- 3 „ chestnut (9 $\frac{1}{8}$ c. f.), at 2s. „
- 3 „ oak (8 $\frac{7}{8}$ c. f.), at 2s. 6d. „
- 2 „ kaka wood (5 $\frac{9}{16}$ c. f.), at 4s. 3d. „
- 3 „ sissoo wood (11 $\frac{3}{8}$ c. f.), at 6s. 9d. „
- 3 „ olive wood (9 $\frac{9}{16}$ c. f.), at 12s. „
- 3 pcs. boxwood (2 cwt. 1 qr. 22 lbs), at 21s. p. cwt.

The pieces of boxwood were remarkably fine specimens, equal in quality to the best Abasia, and fetched a very high price, equivalent to £21 per ton. These logs were depreciated in value for ordinary purposes, owing to their having been squared, which was a mistake, as in that operation much valuable wood had been wasted, and when the bark is removed a good protection to the log is destroyed. In the present state of the boxwood trade, and considering the fact that the supplies which have been coming forward for some time past are deteriorating in quality, from the action of the Turkish Government in closing the forests and from other causes, the probability of a supply of this wood from India is a matter of considerable importance. The usual run of this wood would not however fetch the high price of this picked sample. The best of the other samples received considerable attention, and realised well; much better, no doubt, than if they had been larger parcels. These prices cannot, however, be taken as any criterion, for whether supplies can be sent to this market, and sold at prices which will cover transit and freight, and then leave a profit, is very doubtful. Could these woods, or the best kinds, be regularly placed on the market at moderate figures, there is no reason why a trade should not be developed in them.—(*Ib.*)

MESSRS. MACKENZIE LYALL AND Co. inform us that the following are the present quotations in Calcutta for Moulmain Teak, viz:—

Square Timber, 20 to 29 feet long			
10 to 18 inches square first class	Rs.	70/85	per ton.
Do. 20 to 45 feet long			
14 to 18 inches square	...	100/130	„
Second class Timber ...	...	40/50	„
Planks, long lengths, first class ...	...	75/85	„
Scantlings (of sizes) ...	...	50/80	„

VJ. EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA—

- No. 224F.—*The 22nd April 1880.*—*Mr. W. King*, Assistant Conservator of Forests of the 2nd Grade, now on leave, is transferred from Coorg to the Central Provinces.
- No. 228F.—*The 23rd April 1880.*—*Dr. W. Schlich*, Conservator of Forests in the Punjab, and *Major J. C. Doveton*, Conservator of Forests in the Central Provinces, are promoted, substantively for a time only, from the 3rd to the 2nd Grade of Conservators of Forests, with effect from the 11th April 1880.
- No. 243F.—*The 27th April 1880.*—*Mr. A. E. Wild*, Deputy Conservator of Forests of the 3rd Grade, now on leave, is transferred from British Burma to the Punjab.
- No. 259F.—*The 7th May 1880.*—*Mr. B. Ribbentrop*, Conservator of Forests of the Pegu Circle in British Burma, is appointed, in addition to his own duties, to act as Conservator of Forests of the Tenasserim Circle, during the absence of *Major W. J. Seaton* on six weeks' privilege leave, with effect from the date on which *Major Seaton* may avail himself of the leave.
- No. 272F.—*The 7th May 1880.*—The services of *Mr. B. H. Baden-Powell, O.S.*, Conservator of Forests in the Punjab, are replaced at the disposal of the Government of the Punjab, with effect from the 11th April 1880.
- No. 299F.—*The 25th May 1880.*—*Mr. G. Greig*, Conservator of Forests, Central Circle, North-Western Provinces and Oudh, is promoted, substantively for a time only, from the 4th to the 3rd Grade of Conservators of Forests, with effect from the 11th April 1880.
- No. 307F.—*The 28th May 1880.*—*Mr. G. F. Taylor*, Sub-Assistant Conservator of Forests in the Central Provinces, is appointed to officiate as an Assistant Conservator of Forests of the 3rd Grade, with effect from the 1st April 1880.
- No. 323F.—*The 4th June 1880.*—With reference to the Notification of this Department, No. 940F., dated the 4th December 1879, *Dr. H. S. F. Warth*, Sub-Assistant Conservator of Forests, and officiating as an Assistant Conservator of the 1st Grade in the North-Western Provinces, is confirmed in the latter grade, with effect from the 1st April 1880.
- No. 358F.—*The 15th June 1880.*—In Notification No. 55F. of the 23rd January 1880, granting *Mr. A. T. Drysdale*, Deputy Conservator of Forests in the Hyderabad Assigned Districts, one year's furlough to Europe,—
For Section 18, Chapter IV. of the Civil Leave Code—
Read Section 21, Chapter IV. of the Civil Leave Code.

2.—CALCUTTA GAZETTE—

The 29th April 1880.—*Mr. W. Jacob*, Deputy Conservator of Forests, is allowed an extension of furlough for six months by the Right Hon'ble the Secretary of State for India.

The 27th May 1880.—*Mr. F. B. Manson*, Assistant Conservator of Forests, Kurseong Division, is allowed leave for two days, under paragraph 22, chapter I, section 2 of the Forest Department Code, in extension of that granted to him under orders of the 30th March and 22nd April 1880.

The 23rd June 1880.—The following officers have passed in the subjects mentioned opposite their names :—

1. *Mr. E. G. Chester*, Bengali, by the Higher Standard.
2. *Mr. F. B. Manson*, Bengali, by the Lower Standard.

The 21st June 1880.—*Mr. E. Fuchs*, Assistant Conservator of Forests in charge of the Teesta Division, is allowed leave for three months under paragraph 22 of the Forest Department Code, with effect from the 1st July 1880.

Mr. J. O. McDonell, Deputy Conservator of Forests, Darjeeling Division, is appointed, in addition to his own duties, to have charge of the Teesta Division during the absence on leave of *Mr. E. Fuchs*, or until further orders.

The 24th June 1880.—It is hereby notified, under section 19 of the Indian Forest Act (Act VII of 1878), that the tract of land in the Hazareebagh district, which, in notification of 26th May 1879, it was proposed to constitute a Reserved Forest, shall from the 1st July 1880 be a Reserved Forest under the said Act. The boundary of the said tract is as follows :—

North.—The boundary between the Gya and Hazareebagh districts, from a stream running in a south-west direction to the east of Bisneestekur to the point where the boundary between pergunnahs Koderma and Khurrukdiha meets the Gya district boundary.

East.—The boundary between pergunnahs Koderma and Khurrukdiha, from the above point to a point about half a mile south of Phootlihi river.

South.—A demarcated line in a direction slightly south of east to the source of the river which rises at Phulwariya, and then that river.

West.—The same river, then a demarcated line, first north, then north-east, then north, and then north-east again to the river near Bisneestekur, and then that river.

3.—NORTH-WESTERN PROVINCES AND OUDH GAZETTE—

No. 421.—*The 1st April 1880.*—*Mr. W. E. J. Breton* reported his return from the leave granted to him in this Department Notification No. 85, dated the 21st January 1880, on the forenoon of the 19th March 1880, and resumed charge of his division from *Mr. J. M. Braidwood* at the same time.

The untaken portion of his leave, *viz.*, two days, is hereby cancelled.

Mr. Braidwood had assumed charge of the division on the afternoon of the 5th January 1880.

No. 446.—*The 8th April 1880.*—*Mr. A. B. Grant*, Deputy Conservator of Forests, Ganges Division, furlough to Europe for one year, with effect from the 1st May 1880, or subsequent date, together with the subsidiary leave to which he is entitled under the new rules.

No. 460.—*The 10th April 1880.*—*Major H. O. T. Jarrett, V.C.*, Deputy Conservator of Forests, was relieved of his duties as Divisional Officer, Saharanpur, on the forenoon of the 30th March 1880, by *Mr. J. E. O'Callaghan*, who will hold charge of the Saharanpur division till further orders.

No. 471.—*The 13th April 1880.*—*Mr. G. Greig* reported his return on the forenoon of the 1st April 1880, from the leave granted to him in this Department Notification No. 1, dated the 2nd January 1880, and received charge of the Central Circle from *Captain Wood* on the same date.

No. 491.—*The 24th April 1880.*—With reference to Government of India, Home, Revenue, and Agricultural Department, Notification No. 123F., dated the 20th February 1880, *Major H. O. T. Jarrett, V.C.*, reported his departure for the Central Provinces on the 7th April 1880.

No. 519.—*The 8th May 1880.*—*Mr. J. E. O'Callaghan*, Deputy Conservator, made over, and *Dr. H. S. F. Warth*, Officiating Assistant Conservator, received charge of the Saharanpur Forest Division on the afternoon of the 22nd April 1880.

No. 530.—*The 12th May 1880.*—*Mr. A. B. Grant*, Deputy Conservator, made over charge of the Ganges Division to *Mr. O. Greig*, Assistant Conservator, on the forenoon of the 20th April, and sailed from Bombay on the afternoon of the 1st May 1880.

No. 562.—*The 21st May 1880.*—*Mr. S. E. Wilmot*, Assistant Conservator, 2nd Grade, to Assistant Conservator, 1st Grade, with effect from the 13th April 1880.

No. 582.—*The 26th May 1880.*—*Mr. B. J. P. Pinder*, Sub-Assistant Conservator of Forests, Bahraich Division, four months' leave without pay from the 1st June 1880, or subsequent date.

No. 641.—*The 21st June 1880.*—*Mr. S. E. Wilmot*, Assistant Conservator, 2nd Grade, passed the higher standard language examination prescribed for Forest officers in the North-Western Provinces and Oudh, on the 13th April 1880, in accordance with the rules laid down in this department Notification No. 163, dated the 6th February 1880.

No. 668.—*The 28th June, 1880.*—*Mr. J. O. Murray*, Sub-Assistant Conservator, from the Jaunsar to the charge of the Tons Forest Division.

4.—PUNJAB GAZETTE—

- No. 135F.—*The 1st April 1880.*—*Mr. F. O. Lemarchand* and *Mr. F. D'A. Vincent*, Assistant Conservators of Forests, 2nd Grade, are promoted to the 1st Grade, with effect from the 1st April 1880.
- No. 154F.—*The 8th April 1880.*—*Mr. O. E. Fendall*, Assistant Conservator of Forests, Sutlej Division, is appointed to the charge of the Fuel Reserve, Northern Division, with effect from the afternoon of the 3rd April 1880, *vice Mr. E. Forrest*, proceeding on leave.
- No. 173F.—*The 19th April 1880.*—*Mr. E. Sparling*, Deputy Conservator of Forests, is, on return from the privilege leave of absence granted to him in *Punjab Government Gazette* Notification No. 87 F., dated 26th February 1880, posted to the Fuel Reserve, Northern Division, of which he assumed charge on the afternoon of the 8th April 1880, relieving *Mr. O. E. Fendall*.
- No. 174F.—*Mr. O. E. Fendall*, Assistant Conservator of Forests, is, on being relieved of the charge of the Fuel Reserve, Northern Division, retransferred to the Sutlej Division.
- No. 176F.—*Mr. A. Pengelly*, Deputy Conservator of Forests, is attached to the Rávi Division, with effect from the 16th April 1880, for demarcation of the Chamba Reserves.
- No. 184F.—*The 22nd April 1880.*—*Mr. F. D'A. Vincent*, Assistant Conservator of Forests, Plantation Division, has obtained examination leave of absence for three months, with effect from the afternoon of the 17th April 1880.
- No. 185F.—*Mr. E. A. Down*, Assistant Conservator of Forests, attached to the Plantation Division, is appointed to the charge of that Division during the absence of *Mr. Vincent*, or until further orders.
- No. 242F.—*The 16th June 1880.*—In continuation of *Punjab Government Gazette* Notification No. 34F., dated 19th January 1880, the undermentioned officer has been granted a further extension of leave by Her Majesty's Secretary of State for India, as advised in list dated 14th May 1880:—

NAME.	Service.	Appointment.	Period and nature of extension.
W. Bighy	Uncovenanted.	Deputy Conservator of Forests, 3rd Grade.	Three months' sick certificate.

- No. 248F.—*The 21st June 1880.*—*Mr. F. O. Lemarchand*, Assistant Conservator of Forests, Rávi Division, is appointed to the charge of that Division, with effect from the afternoon of the 31st May 1880, until further orders, *vice Mr. B. Browne*, retired.

No. 255F.—*The 25th June 1880.*—*Mr. O. F. Elliott*, Officiating Deputy Conservator of Forests, Ráwalpindi Division, has obtained privilege leave of absence for two months and twenty-nine days, with effect from the afternoon of the 4th June 1880.

No. 256F.—*Mr. J. S. Mackay*, Assistant Conservator of Forests, Beas Division, is appointed to the charge of the Ráwalpindi Division, during the absence on leave of *Mr. Elliott*.

5.—CENTRAL PROVINCES GAZETTE.—

No. 1358.—*The 9th April 1880.*—*Mr. E. E. Fernandez*, Assistant Conservator of Forests, passed on the 29th ultimo in Hindustani by the Higher Standard.

No. 1500.—*The 22nd April 1880.*—*Major H. C. T. Jarrett*, V.C., Deputy Conservator of Forests, posted to the Chanda Division, reported his arrival at Chanda on the afternoon of the 12th instant, and received charge of the Chanda Division from *Mr. H. Moore*, Assistant Conservator of Forests, on the 15th idem, afternoon.

No. 1501.—*Mr. H. Moore*, Assistant Conservator of Forests, Chanda Division, on being relieved by *Major H. C. T. Jarrett*, V.C., Deputy Conservator of Forests, is posted to the Nagpur Division.

Mr. Moore received charge of the Nagpur Division of forests from *Mr. E. D. M. Hooper*, Assistant Conservator of Forests, on the 17th instant, afternoon.

No. 1625.—*The 30th April 1880.*—*Mr. W. P. Thomas*, Assistant Conservator of Forests, availed himself on the forenoon of the 10th ultimo, of the subsidiary leave granted to him by the Government of India, Home, Revenue, and Agricultural Department Notification.

No. 109 F., dated 17th February last making over charge of the Hoshangabad Forest Division to *Muhammad Ghose*, Forest Ranger.

No. 1792.—*The 13th May 1880.*—*Messrs. E. E. Fernandez*, *E. D. M. Hooper* and *E. Dobbs*, Assistant Conservators of Forests, 2nd Grade, in these Provinces, are promoted to the 1st Grade, with effect from the 1st ultimo.

No. 1823.—*The 14th May 1880.*—Under Section 41 of Act VII. of 1878 (The Indian Forest Act) the Chief Commissioner is pleased to make the following rules:—

Interpretation clause. All words used in these rules and defined in Act VII. of 1878 (The Indian Forest Act) shall be deemed to have the meaning respectively

attributed to them by the said Act.

1. The Conservator of Forests may establish depôts for the examination of timber and other forest produce in transit and for the collection of dues on such timber or produce, provided that the name and situation of each depôt and the route on which it is situated,

Establishment of depôts for the examination of timber, &c.

is notified in every town and village in the neighbourhood of such depôt.

2. No timber or other forest produce shall be moved on any route on which a depôt has been established, unless covered and accompanied by a pass issued by the Forest Officer or by the owner of the forest as the case may be. Such pass shall specify the kind and quantity of timber or other forest produce, the marks it bears (if any), the place it came from, and shall be legibly signed or stamped by the forest officer, or by the owner of the forest or his agent.

3. The moving of any timber or other forest produce through or out of any reserved or any Government forests, except by routes on which depôts have been established under Rule I is prohibited. Provided that the Conservator of Forests may exempt the inhabitants of any locality, or any class of timber or other forest produce from the operation of this rule.

No. 1824.—The Chief Commissioner is pleased, under Section 75 of Act VII. of 1878 (The Indian Forest Act) to prescribe and limit the duties of certain Forest Officers, and to provide for the payment of rewards to certain officers and informers by the following rules:—

The Conservator of Forests, all Deputy Commissioners, Assistant Commissioners, Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators, (whether probationers or otherwise) Tahsildars, Forest Rangers, Foresters, and Forest Guards, whether in permanent or temporary employment, are appointed to do all acts and exercise all powers that are provided by the Act to be done or exercised by "any Forest Officer."

With the exceptions provided by rules 3 and 4, the powers mentioned in the 3rd column of the following schedule will be exercised by the officers mentioned in the 1st column of the same schedule opposite which they appear.

Class of Officers empowered.	Section of the Act under which powers are given.	Brief description of nature of powers conferred.
I.—All Deputy Conservators, Assistant Conservators, and Sub-Assistant Conservators, when in charge of Forest Division.	20	To publish translation of Notifications of reserved forests.
	25	To notify seasons during which the kindling, &c., of fire is not prohibited.
	45	To notify depôts for drift timber, &c.
	46	To issue notice to claimants of drift timber, &c.
	47	To decide claims to drift timber, &c.
	50	To receive payments on account of drift timber, &c.
II.—All Deputy Commissioners, Assistant Commissioners, Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators, and Tahsildars and all Forest Rangers.	62	To sell forest produce for Government dues.
	60	To direct release of property seized.
III.—All Deputy Conservators, Assistant Conservators, Forest Rangers and Foresters, specially authorized in that behalf by the Conservator of Forests.	25	To permit acts otherwise prohibited in reserved forests.
	83	To take possession of forest produce referred to in Section 81 of Act VII. of 1878.

Powers of Conservator. The Conservator of Forests is empowered to exercise all or any of the powers conferred in the foregoing schedule.

In respect of second class reserved forests, Deputy Commissioners will exercise all or any of the powers conferred on the Conservator of Forests.

Powers of Deputy Commissioners.

The Conservator of Forests is empowered, under Section 24 of the Act, with the previous sanction of the Commissioner of the Division, to stop ways and watercourses in reserved forests, subject to the provisions of that section.

All Revenue Officers below the rank of Tahsildar, and all Police Officers up to and including Inspectors, and all Forest Officers including clerks and messengers below the rank of Sub-Assistant Conservator, as well as persons not in the public service, are eligible for rewards under the following rules:—

Certain Revenue, Police and Forest Officers may receive rewards.

On conviction of an offender, the Magistrate by whom the case has been decided is authorized to grant a reward not exceeding the estimated value of the timber or other forest produce, or other articles confiscated, *plus* the amount of any fine imposed (and not exceeding Rs. 100) in such proportions as he may think fit, to any person or persons who may have contributed to the seizure of the property confiscated or the conviction of the offender.

Rewards to informers in cases in which there has been a prosecution.

If in any case the Magistrate considers that more than Rs. 100 should be distributed as rewards, he shall submit his recommendation for a large reward through the Conservator of Forests for the orders of the Local Government, giving his reason for the same.

In cases where, under Section 67 of the Indian Forest Act, a Forest Officer has accepted a sum of money as compensation for any damage which may have been committed, the Conservator of Forests may authorize the payment of a portion of the amount realized as a reward to any person or persons who may have contributed to the discovery of the offender.

Rewards to informers when the offence has been compounded.

No. 1825.—The Chief Commissioner is pleased to invest all Deputy Commissioners and Assistant Commissioners, the Conservator of Forests, all Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators, and Tahsildars, with the powers described in Section 67 of Act VII of 1878 (The Indian Forest Act.)

No. 2286.—The 22nd June 1880.—*Mr King*, Assistant Conservator of Forests, transferred to the Central Provinces by Government of India Notification No. 224 F. of 22nd April last, is posted to the Betul division.

No. 2382.—The 29th June 1880.—Six months leave on medical certificate, under Section 4, Supplement F. of the Civil Leave Code, is granted to *Mr. T. G. B. Atkinson*, Sub-Assistant Conservator of Forests, with effect from 8th May last, or such date as he may have availed himself of the same.

G.—BRITISH BURMA GAZETTE.—

No 26.—*The 24th March* 1880.—The forest in the Tounghoo district, Tenasserim division, having been sanctioned by the Chief Commissioner as a Government reserved forest under sections 13 and 14 of the Forest Rules of 1865, is hereby notified as the *East Swa State Reserve*. Area,—about 27 square miles.

No. 33.—*The 27th April* 1880.—Pending the confirmation of the Government of India, *Mr. B. Ribbentrop*, Conservator of Forests, Pegu circle, British Burmah, is appointed, in addition to his own duties, to act as Conservator of Forests, Tenasserim circle, during the absence of *Major W. J. Seaton* on privilege leave.

No. 34.—*The 27th April* 1880.—Under the provisions of section 44 of the Civil Leave Code, *Major W. J. Seaton*, Conservator of Forests of the Tenasserim Circle in British Burmah, is granted six weeks' privilege leave of absence, with effect from the 17th instant, or from such subsequent date as he may avail himself of it.

No. 35.—*The 29th April* 1880.—Under the provisions of sections 41 and 42 of the Civil Leave Code, *Lieutenant C. F. Bingham*, Officiating Deputy Conservator of Forests, is granted three months' privilege leave of absence, with effect from the date on which he may avail himself of it.

No. 36.—*The 12th May* 1880.—*Mr. B. Ribbentrop* received charge of the office of Conservator of Forests, Tenasserim circle, from *Major W. J. Seaton* on the 28th April 1880, afternoon.

No. 37.—*The 12th May* 1880.—*Major W. J. Seaton*, Conservator of Forests, Tenasserim circle, availed himself of the privilege leave granted to him in this Department Notification No. 34, dated the 23rd April 1880, on the 28th idem, afternoon.

No. 42.—*The 2nd June* 1880.—Whereas it appears to the Chief Commissioner that land is required to be taken up at the public expense for a public purpose, *viz.*, for the construction of a fire-trace round the Kyetpyoo-gan plantation, it is hereby notified that the following land in the district of Hanthawaddy will be appropriated for that purpose:—

A strip of waste land 4,958 feet long by 600 feet broad, bounded as follows:—

North.—The Kyet-pyoo-gan Plantation.

East.—The Rangoon and Prome road.

South & West.—A cut line.

This declaration is made under section 6, Act X. of 1870.

No. 43.—*The 2nd June* 1880.—The forest situated in the Hlaing township of the Hanthawaddy district having been sanctioned by the Chief Commissioner as a Government reserved forest under sections 13 and 14 of the Forest Rules of 1865 is hereby notified as the *Hlaing Yoma State Reserve*, subject only to a public

right-of-way from Sa-kaz-gyee into the Pounclin valley and to any other right-of-way that may be declared by the Chief Commissioner.

Estimated area,—93 square miles.

No. 44.—*The 4th June 1880.*—With the sanction of the Government of India, the Chief Commissioner directs that the following Cutch Reserves in the Proma Forest division (Thayetmyo Civil district) be struck off the list of Government State Reserves:—

Thabyeela Cutch Reserve—area 12½ square miles.

Bangone Cutch Reserve—area 3 square miles.

No. 45.—*The 7th June 1880.*—*Lieutenant C. T. Bingham*, Officiating Deputy Conservator of Forests, availed himself on the 22nd ultimo, before noon, of the three months' privilege leave of absence granted to him in this Department Notification No. 35, dated the 29th April 1880.

No. 46.—*The 7th June 1880.*—The forest situated in the Toungoo district, bounded as below, having been sanctioned by the Chief Commissioner as a Government reserved forest under sections 13 and 14 of the Forest Rules of 1865, is hereby notified as the *Bonedoung State Reserve*, subject only to the privileges enumerated in the appended statement:—

Estimated area,—40 square miles.

No. 47.—*The 14th June 1880.*—*Major W. J. Seaton*, Conservator of Forests, Tenasserim Circle, reported his return on the 4th instant, before noon, from the privilege leave of absence granted to him in this Department Notification No. 34, dated the 23rd April 1880. The unexpired portion of his leave is accordingly cancelled.

7.—ASSAM GAZETTE.—

No. 90.—*The 20th April 1880.*—*Mr. W. E. D'Arcy*, Assistant Conservator of Forests, is declared to have passed in Assamese by the Higher Standard at the examination held on the 25th March 1880.

No. 10.—*The 11th May 1880.*—In exercise of the powers conferred by Section 41 of Act VII. of 1878 (The Indian Forest Act, 1878), the Chief Commissioner of Assam is pleased to make, and, with the sanction of the Governor-General in Council, to publish, the following rules, which shall come into force on and from the 1st day of June 1880:—

CACHAR RIVER RULES.—

I. All words used in these rules and defined in Act VII. of 1878 (The Indian Forest Act, 1878) shall be deemed to have the meanings respectively attributed to them by the said Act.

II. All timber and other forest produce which is brought down by the Barák and Katakhal rivers, or any of their tributaries, in the district of Cachar, shall be stopped for examination, and for the payment of the amounts due to Government thereon, whether as duty, royalty, or on any other account

at the following places, viz. :—

Sonaimukh, on the Barák river ;
Sealtekh, on the Barák river ; and
Jufferbund, on the Katakhal river ;

or at such other places as the Chief Commissioner may from time to time, by Notification in the *Assam Gazette*, prescribe.

III. All amounts so due to Government shall be paid into the Silchar sudder treasury, or into the Háilákándi or Katigora tehsil treasuries ; and the treasury receipts shall be handed to the Forest Office, in charge of the revenue station, who shall thereupon, if requested to do so by the person in charge of such timber or forest produce, grant a pass for the same, in such form as the Chief

Commissioner may from time to time prescribe, and for the issue of which fees will be levied as follows :—

(1) For every raft of timber or bamboos or boat carrying timber or bamboos, and for every raft or boat carrying charcoal	Rs.	As.
...	...	1 0
(2) For every raft of canes or boat carrying canes	...	0 8
(3) For every raft of thatching-grass and reeds or ekra, or boat carrying the same	...	0 4

No person shall remove any timber or other forest produce from any place at which the same has been so stopped, until such pass has been granted by the Forest Officer in charge of the revenue station.

IV. Should the persons in charge of any timber or other forest produce brought down the Barák and Katakhal rivers or any of their tributaries in the district of Cachar desire to land such timber or other forest produce before reaching any of the places prescribed under these rules as places for the stoppage thereof, they shall obtain the permission in writing of the Forest Officer in charge of the nearest revenue station. If such officer deems fit to grant such permission, he shall examine and measure the timber and other forest produce, and shall, on being handed the treasury receipts, acknowledging payment of the amount due to Government thereon, grant a pass as prescribed in Rule III.

V. Except with the permission in writing of the Forest Officer, no timber or other forest produce in transit on the Barak and Katakhal rivers or any of their tributaries in the district of Cachar may be landed or removed inland, nor any such timber be cut up or converted before the amount due to Government thereon has been paid, and a pass has been granted by the Forest Officer for

the same.

No timber or other produce to be removed, and no timber to be cut up or converted, without payment of dues and the receipt of a pass.

for the same.

VI. All timber and other forest produce which is brought down any river in the district of Cachar may be stopped and examined by any Forest Officer or Police Officer, and the persons in charge of such timber or forest produce shall be bound to produce any passes which may have been granted to them under these rules, when called upon to do

so by such Forest Officer or Police Officer.

- VII. Any person infringing any provision of these rules shall be punished with imprisonment of either description, which may extend to six months, or with fine, which may extend to five hundred rupees or with both.

No. 11.—*The 11th May 1880.*—In exercise of the power conferred by Section 39 of Act VII. of 1878 (The Indian Forest Act, 1878), the Chief Commissioner of Assam is pleased, with the previous sanction of the Governor-General in Council, to direct that, on and from the 1st day of June 1880, duty shall be levied on all timber which is brought down from any place beyond the frontier of British India by the Barak and Katakhal rivers, or any of their tributaries, in district of Cachar, at the following rates:—

- (1) For every cubic foot of timber in the rough, of the following kinds:—

	Rs.	As.	P.
Jarul, Nagessar, Cham, Kurta, (all varieties)			
Jhulna, Gundrai, Sutrang, and Kuddum ...	0	4	0

- (2) For every cubic foot of timber in the rough of all other kinds ... 0 2 0

- (3) For every cubic foot of converted timber, the above rates, with an addition of twenty-five per cent.

- (4) For every thousand bamboos ... 2 8 0

No. 13.—*The 13th May 1880.*—The Chief Commissioner has been pleased to amalgamate the Forest Divisions of Sibsagar and Golaghat, with effect from the 1st April 1880.

The amalgamated division will be called the Sibsagar division, and the head-quarters of the division will be at Sibsagar.

No. 125.—*The 18th May 1880.*—*Mr. W. E. D'Arcy*, Assistant Conservator of Forests, 2nd Grade, having complied with the conditions prescribed in the Circular Resolution No. 32 F., dated the 14th August, 1879, of the Government of India, in the Home, Revenue, and Agricultural Department, is promoted to the 1st Grade of Assistant Conservators, with effect from the 1st April 1880.

No. 16.—*The 10th June 1880.*—The Chief Commissioner is pleased to prescribe the following rates of royalty to be paid in the district of Cachar on all forest produce the property of Government, or which was produced on Government land, or on lands belonging to or in the occupation of private persons on which Government has the right to levy a royalty:—

- (1.) For every cubic foot of timber in the rough of the following kinds:—Jarul, Nagessar, Cham, Karta (all varieties), Jhulna, Gundrai, Sutrang, and Kuddum,—four annas.
- (2.) For every cubic foot of timber in the rough of all other kinds,—two annas.
- (3.) For every cubic foot of converted timber, the above rates with an addition of 25 per cent.
- (4.) For every thousand bamboos,—two rupees eight annas.

- (5.) For every hundred bundles of canes (Jali and Sundi), at 76 pieces each,—one rupee eight annas.
- (6.) For every hundred bundles of cane (Gullah), at 76 pieces each,—two rupees.
- (7.) For every hundred cubic feet (rough outside measurement) of thatching-grass and reeds or ekra,—four annas.
- (8.) For every maund of charcoal,—two annas.

8.—MYSORE GAZETTE.—

No. 5.—*The 10th May 1880.*—*Mr. F. B. Dickinson*, Assistant Conservator of Forests, Coorg, is granted examination leave for three months, under Section 22 of the Forest Department Code, with effect from the 1st June 1880.

Mr. M. Muttanna, Probationer, will remain in charge of the Office of Assistant Conservator of Forests in Coorg, during the absence of *Mr. Dickinson*, or until further orders.

No. 7.—*The 11th June 1880.*—In pursuance of Chief Commissioner's Notification No. 5, dated 10th May 1880, *Mr. F. B. Dickinson*, Assistant Conservator, delivered over, and *Mr. Muttanna*, Sub-Assistant Conservator, received charge of the office of the Assistant Conservator of Forests, Coorg, on the afternoon of 2nd June 1880.

9.—BOMBAY GAZETTE—

No. 1675.—*April 2nd, 1880.*—In supersession of that part of Government Notification No. 3329, dated 24th June 1879, which relates to the appointment of *Mr. John McLeod Campbell* as Forest Settlement Officer in the Kolába District, Government are pleased, in exercise of the power conferred by Section 4 of the Indian Forest Act, 1878, to appoint *Mr. R. Courtenay* to be Forest Settlement Officer in that district for the purposes set forth in Section 4, Clause (c), and Section 34 of the said Act.

April 20th, 1880.—*Messrs. H. Mainwaring*, Assistant Conservator of Forests, and *Govind Ramchandra Mahajan*, Sub-Assistant Conservator of Forests, respectively delivered over and received charge of the Sátára District Forest Office on the 14th April 1880, after office hours.

No. 2089.—*21st April 1880.*—*Mr. Lakshman Daji Joshi*, Sub-Assistant Conservator of Forests, Thána, has been allowed privilege leave of absence for one month, from the 5th instant.

April 26th, 1880.—*Messrs. W. J. C. Dunbar*, Assistant Conservator of Forests, and *William Allen*, Second Assistant Collector, Panch Maháls, respectively delivered over and received charge of the Panch Maháls District Forest Office, on the 22nd April 1880, after office hours.

April 25th, 1880.—*Messrs. L. Daji Joshi, and G. K. Sháhaná*, Sub-Assistant Conservators of Forests, respectively delivered over and received charge of the Southern Tálukas of the Thána Collectorate on the 15th April 1880, after office hours.

Messrs. Wamon Ramchandra Gaunde, Sub-Assistant Conservator of Forests, and *A. D. Wilkins*, Assistant Conservator of Forests, respectively delivered over and received charge of the Ratnágiri District Forest Office on the 15th April 1880, before office hours.

May 20th.—*Mr. George Hewett*, Assistant Conservator of Forests, left charge of his office as Assistant to the District Forest Officer, Khándesh, on the 11th May 1880, after office hours.

Messrs W. Allen, Second Assistant Collector, Pánch Maháls, and *George Hewett*, Assistant Conservator of Forests, respectively delivered over and received charge of the Panch Maháls District Forest Office on the 14th May 1880, before office hours.

No. 2662.—*22nd May 1880.*—*Mr. T. B. Fry*, Assistant Conservator of Forests, Second Grade, has been promoted to the First Grade from 1st April 1880.

No. 2708.—*25th May 1880.*—*Mr. H. Barrett*, Deputy Conservator of Forests, First Grade, has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of his leave.

16th June 1880.—*Messrs. W. A. Talbot*, Assistant Conservator of Forests, and *H. Barrett*, Deputy Conservator of Forests, delivered over and received charge respectively of the Dhárwár Forest Office on the 15th instant, after office hours.

No. 2878.—*4th June 1880.*—His Excellency the Right Honourable the Governor in Council is pleased to prescribe the following Rules for the Examination of Forest Officers in this Presidency in supersession of the Rules published at page 94 of the *Bombay Government Gazette* of the 5th February 1874:—

1. Every officer joining the Forest Department in the Bombay Presidency shall pass an examination in one of the vernacular languages of the Presidency—Maráthi, Gujaráthi, Kánarese or Sindhi—and in surveying according to the Lower Standard, provided that officers who hold the certificate of having completed the professional education prescribed by the Secretary of State shall not be required to pass again in Surveying.

2. The test in the vernacular language shall be that prescribed for junior Civilians before their investiture with third class Magisterial powers.

3. This examination will be held before the Central Committee for Vernacular Examinations or such other Committee as Government may appoint specially for the purpose.

4. Every officer shall present himself for examination in the vernacular language of the district in which he is employed at the first meeting of the Central Committee held after he has been nine months in the service, and he shall be liable to lose his appointment if he fails to pass at the first examination held after he has been eighteen months in the Forest Department.

5. The test in surveying according to the Lower Standard will be as follows:—

A circuit round an area of not less than two square miles of flat country to be traversed with a prismatic compass and chain; the bearings, distances and offsets to be recorded in a field-book, and to be plotted on a scale of not less than 8 inches=1 mile.

The roads, paths, streams, houses and other topographical features to be filled in by plane table and chain. If the officer conducting the examination certifies that no plane table is available, the interior detail should be filled in by prismatic compass and chain. A line not less than one mile in length to be levelled throughout from both ends, and the sections to be afterwards plotted on a scale of 8 inches=1 mile for horizontal distances, and not less than 20 feet=1 inch for vertical distances.

6. To qualify for promotion to the post of Assistant Conservator of Forests, Second Grade, an examination in the following subjects must be passed by an Assistant Conservator of the Third Grade:—

First.—The vernacular language of the district in which he has been employed according to the Lower Standard examination test for junior Civilians, if this test has not already been passed.

Second.—Surveying according to the Lower Standard, if he has not already qualified in this subject.

Third.—The Indian Forest Act No. VII. of 1878.

Fourth.—Departmental rules, accounts, standing orders relating to forests and official business.

Fifth.—The land revenue system of the district in which he may have been employed.

In addition to the above a certificate must be obtained from the Conservator of Forests of the Division, in the form prescribed, that the Assistant Conservator is competent to hold charge of a Forest District.

7. To qualify for promotion to the First Grade of Assistant Conservators, an Assistant Conservator of the Second Grade must pass an examination in the vernacular language according to the Higher Standard examination test prescribed for junior Civilians; must be certified by the Conservator of Forests to be fully competent to hold charge of a Forest District; and must be considered to have merited promotion.

8. An officer transferred from one district to another district, in the vernacular language of which he has not passed, will be required to pass an examination in the vernacular language of his new district, according to the Lower Standard examination test within one year of transfer.

9. Certificates of qualification by the Higher Standard of surveying may be granted to Forest Officers proficient in the following branches of surveying, *vis*:—

Forest Department Code,
Addenda and Corrigenda,
No II, 2.

In the Field.

1. Survey with chain only.
2. Survey with prismatic compass and chain, and plot by angles and distances.
3. Traverse with chain and circular protraction.
4. Traverse with theodolite, chain and clinometer.
5. Connection of traverses with trigonometrical stations.
6. Triangulation.
7. Survey with plane table and chain.
8. Survey of hilly ground with plane table (to include the fixing of ridges and streams and the production of an intelligible map).

In Office.

1. Reducing and enlarging a map by squares and triangles.
2. Use of the pentagraph.
3. Use of the planimeter.
4. Methods of calculating areas roughly.
5. Computation of traverses.
6. Reduction of distances from clinometer readings.
7. Drawing up a chart from numerical data.

23rd June 1880.—*Messrs. W. B. Woodrow*, Assistant Conservator of Forests, and *W. S. Hexton*, Deputy Conservator of Forests, respectively delivered over and received Forest charge of the Supa Táluka of the Kánara Collectorate on the 21st instant.

24th June 1880.—*Messrs. W. S. Hexton*, Deputy Conservator of Forests, and *W. B. Woodrow*, Assistant Conservator of Forests, respectively delivered over and received Forest charge of the Honávar Táluka of the Kánara Collectorate on the 19th instant.

Messrs. W. S. Hexton, Deputy Conservator of Forests, and *W. A. Talbot*, Assistant Conservator of Forests, respectively delivered over and received Forest charge of the Kumta Táluka of the Kánara Collectorate on the 19th instant.

29th June 1880.—*Messrs. G. E. Hewett* and *W. J. C. Dunbar*, Assistant Conservators of Forests, respectively delivered over and received charge of the Northern Circle District Forest Office on the 24th instant, before office hours.

THE INDIAN FORESTER.

Vol. VI.]

OCTOBER, 1880.

[No. 2.

Alfred Pengelly.

MOST of our readers will have heard ere this that Alfred Pengelly has been killed by a black bear throwing him down a precipice in Chamba. By his death Government has lost an excellent servant, and all those who had the privilege of being personally acquainted with him, deplore the untimely death of one whose character was without a blemish.

Alfred Pengelly, born in 1843, was the son of William Pengelly, Esq., F. R. S., F. G. S., etc., who resides at Torquay, and who is well known as a scientific geologist. In the year 1852, when 9 years old, he left his home for school, spending five years at Sidcoe in Somersetshire, two years at Bootham in the city of York, and two years at the Flounder's Institute, Ashworth, Yorkshire. From 1861 to 1863 he spent as junior teacher at Bootham, York.

In 1861 he matriculated at the London University, but instead of proceeding to his degree at that University, he entered, in October 1863, at Christ's College, Cambridge, where he gained a mathematical scholarship, and was a senior optime in the Mathematical Tripos in 1866. He became Master of Arts in 1869 if we are not mistaken.

In spring 1867 Her Majesty's Secretary of State for India decided on offering a certain number of appointments in the Indian Forest Department to young Englishmen, the appointments to be filled by means of a competitive examination, and the successful candidates to be sent either to Germany or France for the purpose of studying forestry, preparatory to their joining their appointments in India. Alfred Pengelly headed the list of the first year, and he arrived after having spent two and a half years at the French Forest School at Nancy, and in the forest of Haguenuau, arriving in India towards the end of 1869. He was posted to Sind, where he, in conjunction with Mr. F. R. Dasai, assisted Dr. W. Schlich, then on special duty in Sind, in the examination of the forests of that province, and in the collection of data for a working plan.

Owing to repeated attacks of low Sind fever, he was, in 1871, transferred to the North-Western Provinces, and stationed at Chakrata.

For some time he was in charge of the forests near the military station of Ranikhet, where he organized the supply of wood to the Cantonment, and demarcated a portion of the reserves destined to supply the station with forest produce.

In 1875 he was engaged in making an examination of the Kumaun Iron Works Forests at the foot of the hills below Naini Tál, in the Kotah Division.

In October 1876, his services were placed at the disposal of the Government of the Punjab; he did however not join in the Punjab until in February 1877, when he was appointed to the charge of the Ravi Forest Division, and instructed to push on the demarcation of the Chamba reserves.

In February 1878 he proceeded on one year's furlough. On his return in February 1879, he was posted to the charge of the Fuel Reserve Northern Division, but already in May of the same year he proceeded on six month's leave on urgent private affairs, from which he returned in December 1879. He was then attached to the direction and employed in the examination of the Lahore rakhs.

On the 1st January 1880, he took temporarily charge of the Conservator of Forests' Office, until the arrival of the new Conservator on the 26th January 1880, when he returned to the examination of the Lahore rakhs.

Early in April 1880 he proceeded to Chamba, specially charged with the demarcation of reserves in that State. In this work he made capital progress.

It was early in the morning of the 29th July 1880, when his servants woke him and told him that a black bear was close by eating the villagers' fruit. He dressed quickly, went out, fired at the bear and missed it. The latter went off, and Alfred Pengelly followed it up with a favourite and most excellent little fox terrier, "Vixen." He traced the bear to a cave, situated above a precipice, and approachable only by a narrow path. Vixen could not be stopped, and went in at the bear. Alfred Pengelly, hearing his dog being punished by the beast, went to his assistance along the narrow path. Suddenly the bear rushed out, and before he could fire, Alfred Pengelly was seen falling over the precipice. Whether the bear actually pushed him down, or whether Pengelly, in trying to avoid the bear, stepped over the edge of the precipice, has not been ascertained. He fell clear down for upwards of 300 feet, and death was instantaneous.

Having stood at the head of the first year's trained English Forest Officers, Alfred Pengelly may be called the leader of that section of the forest service, which position he filled most worthily, not only on account of his attainments in general and

forest knowledge, but also, and perhaps more so, because of his thoroughly upright and simple-minded character. He was a true friend; and although his life cannot boast of any specially brilliant episodes, yet he was a man one does not meet with every day.

Alfred Pengelly married about two years ago. He lost his only child nearly a month before his death, and he leaves a young widow mourning his loss.

Sw.

Proposed fire protection in the forests along the south-western declivity of the Sewalik Range for the purpose of diminishing the floods which now reach the Ganges Canal.

NUMEROUS as the opportunities are for demonstrating in India the fact that the damage done by floods may be diminished by creating or improving forests on hitherto more or less barren hill tracts, it is rare that actual measures can be taken. The damage done by the floods, or the advantages to be derived from their cessation, must be very obvious and striking to cause the necessary outlay to be granted. The following are instances where special circumstances have caused, or are expected to cause, immediate measures.

Mr. Baden-Powell brought to notice the very serious damage done by torrents locally called "Chôs" in the Hoshiarpur district. These Chôs spread so much sand from the barren hills over the adjoining plains that every year the cultivated lands are more seriously encroached upon.

In Ajmere and Merwara the water is very scarce, and everything depends upon the proper utilization of the rainfall. For this purpose the hill sides were brought under protection, and the new formed forest growth is expected to prevent silting up of valuable tanks, to diminish the excessive evaporation of water from the ground, to produce a more permanent subterraneous flow of water to tanks and wells, and to attract more rain.

In the Pabbi hills, near Jhelam, a system of protection was commenced by Mr. Reuther, with the same object of economizing the rainfall, and regulating its discharge from the surface.

In the case of the south-western declivity of the Sewalik Range, the floods, which rush down in numerous mountain torrents (called Raus) during the rainy season, cross the lines of the two great canals, the Ganges and the Eastern Jumna. The great importance of these canals, and the enormous cost of the engineering works required for their protection, supply the special motive for improving the forests of the drainage area of the torrents.

It cannot be said that the south-western declivity of the Sewalik is devoid of forest. There are forests, but they are less than half stocked with trees, and there is a very scanty undergrowth and little soil, by reason of the fires which pass through them every dry season, and cause continual damage. By merely keeping out the fires, the growth of the forest and the accumulation of a protecting layer of vegetable mould would be much favored, so that in the course of some years a great improvement would take place. The discharge of the rain water from the surface would be spread over a greater length of time, and the sudden floods of only a few hours duration, which are now so dangerous, would be reduced. Further, the amount of detritus and sand now carried down upon the lines of the great canals would very much diminish.

The provision made at the Ganges canal for passing off the floods from the Sewaliks is of four different kinds:—

(a). The minor drainage channels are simply permitted to enter the canal.

(b). Two rivers, the Ranipur and the Patri, are conveyed over the canal by super-passages.

(c). The Ratman river passes through the canal by means of dams and sluices on a level with the canal.

(d). The Solani passes underneath the Ganges canal, which is carried on the great Solani aqueduct.

The total cost of these works was nearly half a crore of rupees. Compared with the mere interest on such a sum, irrespective of the cost of maintaining the works, the cost of protecting the whole forest area from fire is quite trifling.

The matter having been laid before the Government of the North-Western Provinces, it remains to be seen whether the Canal Department will consider it their interest to contribute towards the expenses of protecting the forests from fire. One portion of the area deserves first attention, that of the Ratman river basin. It includes ten miles length of the Sewalik range. The arrangements for crossing the Ganges canal at the Ratman are of a less permanent character. They involve the keeping up of a permanent establishment for the working of the sluices, by which the floods and the canal water are alternately passed off. They cause repeated stoppages of the canal, and the floods must carry large quantities of detritus, not only through the canal, but also into the canal. Arrangements will, therefore, be made for protecting the mountainous portion of the Ratman catchment area. The cost of protection will only be about Rs. 2,000 a year, whilst the engineering works at the Ratman represent a capital of five lakhs of rupees, with Rs. 20,000 mere interest every year.

The questions now, are : *Firstly*, to what extent the floods will be finally reduced? *Secondly*, to what extent will the transport of debris and sand across the Ganges canal be reduced?

Thirdly, what period of successful fire protection will elapse before marked effects will be observed? And, *Fourthly*, when will the maximum effect have been approached?

H. WARTH.

DEHRA DUN, the 27th July 1880.

Durability of Indian Railway Sleepers, and the rules for marking them.

THE following is an abstract of the replies received from the several railway authorities to an enquiry made by Government as to the durability and average age of railway sleepers of the different kinds of wood in use:—

East Indian Railway.—Cannot give any definite information as to the ages of the different kinds of woods used for sleepers on this railway, as the system of branding has been defective.

Speaks of sál as being the most durable of Indian woods, and states that the average life of sleepers of sál on the railway has been 14 years.

Eastern Bengal Railway.—Teak, sál, jarúl, and iron-wood sleepers in use: average ages:—

Teak	...	...	...	...	14 years.
Sál	...	...	...	...	13 "
Hard-wood, Jarúl, &c.	...	...	...	...	8½ "
Iron-wood	...	...	...	...	12 "

Consulting Engineer explains that these figures show the time the sleepers have already been on the line.

Creosoted pine sleepers obtained from England are also in use, and some, which have been 18½ years in the road, are yet serviceable.

Northern Bengal Railway.—Sál in use, but for so short a time that it would be difficult to pronounce any definite opinion as to its durability.

63,000 sál sleepers laid, time about four years, and renewals have been at the rate of 14 per cent. Government of Bengal is of opinion that this percentage is due to the use, in the first instance, of sapwood; it having been found that where heart wood was used, no signs of splitting or decay have appeared, and that on the whole sál sleepers make a very satisfactory road.

Tirhoot Railway.—Deodar and sál sleepers in use. The former has been laid over 5 years, and most of the sleepers on the line show no signs of deterioration. There have been failures, but these, it is stated, are due to the necessity for frequent shifting, and the consequent use of additional spike

holes, when relaying, resulting in splitting; these sleepers were originally laid on the famine line.

Sál has been laid over two years, and so far has stood well.

Creosoted pine also in use, but does not last as well as deodar or sál.

Calcutta and South-Eastern Railway.—Manager finds sál and teak more durable than creosoted pine, the average life of which is given at three or four years. He says nothing, however, as to the age of sál and teak.

Punjab Northern and Indus Valley Railways.—No records kept up hitherto.

Deodar in use on both railways, and creosoted pine also on the latter.

Nalhati Railway.—Red gum and creosoted pine in use; former more durable.

Sind, Punjab and Delhi Railway.—Deodar and creosoted pine in use.

Deodar, average life	...	...	12·34 years
Pine	"	...	16·35 "

No jungle woods in use on the *Rajputana Railway*.

The Government of India have prescribed the following rules for the marking and registration of sleepers:—

Rules prepared by the Consulting Engineer to the Government of India for State Railways, for the Marking and Registration of Timber Sleepers.

The present system of branding sleepers will be discontinued, and a system of marks on zinc nails will be substituted for it.

2. The marking and registration will be confined to a few selected miles.

3. The miles on which registration is to be adopted should be selected so as to afford different conditions of curve, gradient, ballast, &c., which may affect the life of a sleeper.

4. Every kind of timber in extensive use for sleepers should be included in the selected miles.

5. In case any railway is less than 50 miles in length, no detailed sleeper registration need be kept.

6. On lines exceeding 50 miles in length, the number of miles selected for registration shall be one for every 50 miles of railway, but shall not exceed a maximum of five miles on any one railway.

7. For marking sleepers zinc nails will be used of the size and shape shewn in the sketch.

8. The zinc nail is to be driven into a countersunk hole, and on the head of the nail is to be punched the necessary marks for registration. After the marks have been punched, the countersunk hole is to be filled in with putty, which may remain until the sleeper is removed from the line.

9. The character of the wood in the sleeper will be indicated by a letter on the head of the nail, as below :—

A—Australian Timber,
B—Babul,
C—Chil,
D—Deodar,
E—Creosoted pine from England,
T—Teak,

and such other letters as may, from time to time, be agreed upon, to denote timber not included above.

10. Figures on the head of the nail will denote the year in which the sleeper is laid in the road.

11. Thus the mark $\frac{D}{88}$ denotes that the sleeper is of deodar, and has been laid in the road in the year 1880.

12. The nail should be driven in on the top of the sleeper, about four inches from one end.

13. There will be no separate store mark on any sleeper registered.

14. The line denoting the half of the year will be discontinued.

15. These rules will cancel Government of India Circular No. 292-315 S. R., dated 27th February 1873.

16. A report on all sleepers, taken out of the selected miles, must be sent to Government at the end of every year.

G. L. MOLESWORTH.

31st January 1880.

Frosts and Forests.

BY E. E. FERNANDEZ.

THE orders of the Government of India, on the Progress Report of Forest Administration in the Central Provinces for 1878-79, while commenting on some observations made in the Report concerning the effects of the severe frosts of the winter of 1878-79 on forest trees, say :—

"The damage done to young trees by frost seems to be a real difficulty in certain localities in the Central Provinces, and it would be of advantage if some of the young Forest Officers could study the subject, and could compile all available observations regarding it, so as to determine the greater or less susceptibility of different species of trees in this respect."

The widespread injurious effects of frost to be witnessed every year in our forests by the most casual observer, struck me from the very first as being one of the most important points to be inquired into before making any serious attempt to restock the large areas of sparse scrub, of which we have become the custodians. Much as I desired it, yet I have

never had either the opportunity or the leisure to carry out that long and sustained series of careful and complete observations, without which all deductions must run the risk of being drawn from insufficient data. But for my own benefit, I have jotted down, whenever the chance occurred, a few notes *en passant*, and since the winter of 1877-78 I have, whenever I could, registered the minimum night and morning temperatures of each day during the cold season. I have thus been able to draw certain general conclusions regarding the effects of night frost on our forest trees. Many of these generalisations will, no doubt, have to be considerably modified, and some even entirely abandoned with more extended and exact observations. But as somebody must make a beginning, I have ventured to state here briefly the results I have been able to arrive at, trusting that others, with more leisure for independent work, or more advantageously placed than myself to observe special phenomena, will freely criticise and record their own experiences in our Forest Journal. In this manner we shall, in time, come into possession of a complete body of facts respecting a subject, the capital importance of which, in silviculture, is beyond question. If we will only discover sufficient earnestness of purpose in the matter, Government will, no doubt, give every encouragement by supplying the necessary instruments, and affording special facilities for research to a select few, whose tastes and attainments lie in the direction of Forest Meteorology. That this encouragement will not be wanting, when the occasion arises, may be inferred from the orders of the Government of India, quoted at the head of this paper.

I will begin by describing, briefly, what we know concerning the general action of frost on the vegetable kingdom. Without possessing so much preliminary knowledge, it is obviously impossible to study with any fruit the special susceptibilities of our various forest species to frost. Writing out in camp, and under the continual pressure of official duties, I shall no doubt unavoidably omit to notice many points which have been recently, and are being daily, cleared up by the researches of learned German and French vegetable physiologists. Nearly all my illustrations will be taken from facts that have come under my own personal observation.

All parts of plants are bad conductors of heat, more especially so the wood and the corky layer of the bark. The relative conductive powers of wood, glass and copper are as 1 : $5\frac{1}{2}$: 12,500, while the conducting power of cork is much lower than that of wood. Hence the temperature of the bark and wood of massive stems rises and falls very slowly. The result of this is, that while the temperature of the air is rising, such stems are colder than the surrounding air, and reach their maximum temperature after that of the day has

been attained, the former maximum being of course lower than the latter. On the other hand, as the surrounding air cools much more rapidly than the stems, these are warmer at night than the air, and naturally attain their minimum temperature after the temperature of the air has fallen to its lowest point, and has begun to rise again. They, therefore, never reach so low a temperature as the surrounding air. Thus is explained the almost complete immunity of dormant buds to the effects of frost—thanks to the protective covering of the outer bark, when once the rhytidom has been formed. Hence also the fact that frost seldom kills a well established seedling outright, the part suffering being only the herbaceous portion, the pith of which is still unprotected by a sufficiently thick woody sheath.

But the most energetic cause of fall of temperature in plants, as well as the most rapid in its effects, is, without question, radiation. Hence the roots and the buds at the collum suffer much less than the portions of the plant well above the ground, and, therefore, more freely exposed. Other things being equal, it is obvious that rapidity of radiation is directly proportional to the extent of radiating surface. It hence follows as a corollary, that (*ceteris paribus* understood) the greater the proportion of radiating surface to mass is, the greater will be the susceptibility of the plant in question to frost. We can now understand the reason of the higher sensitiveness to frost of species with large leaves, or with buds, leaves, and internodes possessing a hairy, warty or rough surface, as, for instance, *Sterculia urens*, Teak, *Terminalia belerica*, *T. tomentosa*, *Buchanania latifolia*, *Bombax malabaricum*, *Gmelina arborea*, &c. Thus also may be explained the predominance and more or less complete exclusiveness of the needle-leaved trees (*Coniferae*) in high latitudes and at lofty elevations.

The energy with which those parts of plants which have an extended surface radiate, is shown by comparing the respective temperatures marked during a clear night by a freely exposed thermometer, resting directly on turf, and by another placed in the air a certain height above the former. The first may register frost, while the second still stands some degrees above freezing point. A further illustration of this fact is afforded by nature herself in the greater abundance of dew and hoar frost deposited on plant parts possessing an extended surface.

If water, containing other substances in suspension, be subjected to the process of freezing, it will be found that, as freezing goes on, the mixture separates, on the one hand, into pure water which congeals and forms ice, and on the other, into a concentrated solution of the suspended substances, the freezing point of which solution is below that of water.

Moreover, as the learned Ruedorff has demonstrated, the act of concentration itself of these substances induces many chemical changes, new compounds being actually formed.

The water contained at any time in a plant is there present in two different ways. One portion of it exists therein as a free liquid, holding certain substances in solution: this liquid is the CELL-SAP of modern botanists. The other portion of the water surrounds and clings fast, by the force of adhesion, to the molecules of the cell-wall, and the substances in the protoplasm, and its quantity remains more or less constant. Physicists apply the term HYDROSTATIC to water in this state. The most perfectly seasoned (air-dried) wood contains hydrostatic water, which can only be expelled by continual exposure to a temperature not lower than that of steam. Now under the action of frost, the hydrostatic water remains unaffected, whereas the water of the cell-sap separates from the protoplasm, and the substances held in solution in it, and oozing out through the cell-wall becomes frozen *outside* the cells (never *inside*). During the process of freezing, the ice crystals grow on by additions to their base, as the water gradually issues from the cell to the outside of the cell-wall. If the frost lasts long enough, the outer surface of the cell-walls becomes encrusted with a constantly thickening coat of ice crystals. As the water within the cell is thus constantly diminishing, the walls of the cells collapse inwards, and the turgescence of the tissues is thus destroyed.* These last become broken, and in the case of large watery leaf stalks, like those of the artichoke, the epidermis becomes completely disunited from the internal tissues, and covers them merely as a loose sac or sheath. Sachs obtained 99 grammes of pure ice, from 398 grammes of an artichoke stalk, or 25 per cent of the total weight of the original stalk. After the frost of 25th November 1879, at Kirgaon, I examined several frost-bitten teak seedlings, some of them five feet high, and found that the connection between the bark and the enclosed stalk had been destroyed in many places. According to Caspary the crystals sometimes grow outwards like combs, the teeth of which gradually tear through the epidermis and protrude out.

When thaw sets in, the ice melts. If the thaw is gradual, the liquefied ice may be reabsorbed by the cell and the cell-contents, provided the frost has not been severe enough to have already injured the tissues beyond all chance of recovery. In that case all the melted ice may be reabsorbed, and the disrupted tissues may reunite, and resume their wonted functions. Indeed it is seldom that death is the direct result

* This collapse is seen in a very striking manner in the frost-bitten tender shoots of the orange plant.

of freezing. For the most part it is caused by rapid thaw, for then the quantity of water outside the walls of the cells becomes all at once too large to be absorbed, and fills up the spaces between the disrupted tissues, usually with a fatal result, causing decomposition of the cell-contents, and the destruction of the molecular structure of the protoplasm and cell-wall.

Watch frozen leaves before thaw begins. As a rule, even when the frost is very severe, they all present the same appearance. Those that are ultimately to die are undistinguishable from those that recover afterwards. But as thaw gradually sets in, little by little the turgescence of the former collapses, discolouration commences, and the leaves gradually dry up, or shrivel up and die.

In the teak seedlings at Kirgaon, referred to higher up as having had the bark disunited from the internal tissues, I found some water in the intervening spaces, after the portion of stem containing them was quite dead, proving that this, so to say, extravasated water could not be reabsorbed. And one of these seedlings, five feet high, which I cut on the 31st January 1880, showed that the pith, and all the tissues of the upper six inches of the stem, were quite rotten from excess of moisture. As I continued making sections lower down the stem, I found the cambium of the bark and wood quite black and rotten all round down to within one inch of the crown of the root, where the woody sheath had not attained a greater thickness than one-sixth of an inch; the woody tissue and pith also were black and rotten. Lower down the stem, where the ring of wood was more than one-sixth inch, but less than a quarter inch thick, both the pith and wood were discoloured and decomposed on two opposite sides, vertically, below the two intervening spaces between the points of attachment of the immediately upper pair of leaves. The other two sides of the rectangular stem were apparently unharmed, owing, no doubt, to the leaves just above them being able to draw up at once, thanks to their suction power, any excess of moisture collected vertically under them. Thus it was clear that whatever the other causes of death were, the immediate cause was excess of moisture which could not be reabsorbed, and which ultimately brought about the decomposition of the tissues affected.

Chemical changes produce a dusky colour in the extravasated sap just as in ordinary expressed sap, and in the case of leaves and herbaceous stems, rapid evaporation soon causes a complete drying up of the dead tissue. The *Butea frondosa* leaf becomes quite brittle within two hours after the setting in of thaw.

The substances left behind in the cell, after the water has frozen outside on the cell-wall, may undergo decomposition, and enter into new combinations. The chlorophyll grains may

become disorganised, the whole protoplasm becoming cloudy and of a brownish or yellowish colour, as in the leaves of the Orange, *Anogeissus latifolia*, *Butea frondosa*, *Pterocarpus marsupium*, *Elæodendron paniculatum* and a host of other trees, or it may become a dusky green as in the *Terminalia bellerica* or assume a blotchy, pale leprous green, as in the partially frost-bitten leaves of the Bér. In other cases the chlorophyll may remain unchanged, while coloured masses, either red or pale yellow, form and occupy the upper part of the cells of the superior surface of the leaves, as in the *Sedum* and *Mahonia*. The red colouring matter here is soluble in water, and gives, on spectrum analysis, the same bands as the red colouring matter of flowers. The change is due to the colouring of the part by radiation. Light does not cause any alteration, and the green colour is restored when the temperature rises. The restoration is a slow process, while the change in colour may be effected in a single frosty night. I would recommend this point to the attention of our Himalayan foresters.

We are now at liberty to lay down the following general proposition, *vis.*, that the greater the quantity of water in the cell-sap is, *cæteris paribus*, the larger will be the quantity of ice formed, the more marked the collapse of the cell-wall, the severer the disruption of the tissues, and the more dangerous the effects of a rapid thaw. We thus see why the sap-gorged tender teak shoot falls an easy victim to frost; also why the *Boswellia thurifera* and *Odina Wodier* are more easily affected by frost than the Anjan and the Bér; and why the *Phyllanthus Emblica* is at once frost-bitten, while the Khair escapes, although, so far as leafy expansion is concerned, the two stand more or less on an equality. We can now understand why air-dried seeds undergo almost any degree of cold without losing their germinative power, and why winter buds of woody plants, that lose their leaves in autumn, withstand all alternations of frost and thaw. These buds are as rich in assimilated solid substances as they are poor in water. Again the reason is now obvious why, in countries where the winter or season of dormant vegetation is immediately succeeded by a well-marked spring or season of reawakening vegetable life, late frosts are always attended with fatal results (all the new shoots are at this time saturated with water); whereas, in countries like most parts of India, where the season for the cessation of growth of the principal forest trees is not the cold season, but quite a different one, *vis.*, the hot weather, which intervenes between the former and the revival of vegetation, it is, of course, evident that the later a frost occurs, the less it is to be feared. On the other hand, it is clear that early frosts are dangerous everywhere, for nowhere, at the time when they occur, is vegetable growth in a quiescent state. To use the vulgar, rather inaccurate, but

forcible phrase, "the sap is still up." The tissues, especially those of the herbaceous portions (stalks, leaves and buds), are more or less gorged with sap, and as growth or rather the metamorphosis of assimilated matter is still going on, the sap is thin and watery. We thus see why in India, and in other countries in which vegetable growth is continued although with constantly decreasing activity throughout the whole winter, to cease only at the commencement of the immediately ensuing hot weather, frosts, even the mildest, are always to be dreaded.* Hence it is not quite correct to say, as even many scientific foresters are wont to express themselves, that the year's shoots succumb to early frosts, because they are not yet "properly or sufficiently liquefied." At best this way of putting the fact conveys only a partial truth, and is extremely misleading. It is quite true that proper lignification by interposing a sheath of a badly conducting substance like wood, protects the pith against the cold of the outside air; but what effect can it have on the buds, the death of which means the death of the shoot? Moreover, the woody sheath must be fairly thick, if it is to afford the necessary protection to the pith. At the Kirgaon Nursery in Nimar, the pith of teak seedlings was killed by frost although surrounded by wood one-sixth inch thick. The main point to remember is that, in order that the shoot in question may be placed in the best conditions to withstand frost, the growing season must have passed, or be sufficiently advanced, for the sap to contain the greatest proportion possible of solid matter in the shape of the reserve food stored up for use at the beginning of the next growing season.†

Plants possessing tough leathery leaves, like the *Celastrus senegalensis*, *Hardwickia binata*, Pipal, Bér, the Mistletoes, &c., generally resist frost well, and the mosses, fungi, and the so-called lichens, which are nearly always dry and leathery, seem never to be affected at all. The texture of their tissues, as well as the smoothness of their parts is, no doubt, one of the chief causes of their low radiating power. But the present state of our knowledge on this point is not sufficiently advanced to warrant any general rule being deduced. We can, until further study brings new facts to light, only say that the nature itself of the plants conduces in a manner still undefined to the faculty it possesses of resisting frost. With respect to the mosses and fungi, and what we shall still call lichens, we know that their

* This fact cannot be too much insisted upon, for people, carried away by the present acclimatisation mania, fondly imagine that because trees from the temperate zone stand the most rigorous winters in their own native clime, it therefore follows that they will thrive when transplanted to the highlands of India, if only the conditions of soil, temperature, and rainfall be the same. Let them remember that our alternation of seasons is not the same, and that rapid, almost instantaneous, thaw is the invariable rule, not the exception.

† This remark does not apply to leaves, which seem to be more sensitive the nearer they are to their shedding time, as will be seen lower down. The question here is the vitality of the shoot itself.

vitality is not only proof to extremely low degrees of cold, but also to complete drying up, whether this is caused naturally or artificially.

In the same way different varieties of the same species are distinguished by their different degrees of sensitiveness to frost. I have myself no doubt that careful and intelligent study will show that these various relative degrees are simply the combined result of modifications effected in the size of the leaves and in the nature of their surface, in the rapidity and vigour of their growth, in the period of the year for the fall and renewal of their foliage, &c. So far as frost is concerned, the acclimatisation of a plant, introduced into a country the meteorological conditions of which differ from those of its habitat, is possible only on the supposition that such favourable modifications can be gradually produced.

A little reflection will show that the depth, nature, and composition of the soil and sub-soil, in which a plant has its roots, influence, to a considerable extent, its sensitiveness to frost. When the soil is favourable, and growth rapid, early frosts will find the shoots charged with sap, and vegetation still more or less active, these circumstances being aggravated in countries possessing seasons like ours in Central India, where all forests possess the characteristic of early frosts. On the other hand if the soil is poor and shallow, and the sub-soil is hard, and presents no facilities for the penetration of the roots into it, like the masses of sheet rock, which form so peculiar a feature of a great part of the trap country, the roots remain superficial and exposed to extreme alternations of temperature, and the shoots of the year are thin and weakly, and experience the effects of frost in their greatest intensity. Thus in the cold weather of last year, young *Hardwickias* growing on sheet-trap in the Khandwa reserve, and in the moist, rich, deep-soil, sandstone valleys of Punasa, were all more or less frost-bitten, while those standing in medium soil or on freely fissured rock, were scarcely touched at all. Again in the cold weather of 1877-78, the Bér bushes in the deep, moist, rich soil below the village of Deal in Kalibhit suffered very severely, more so even than Dhaora (*Anogeissus latifolia*) in medium soils, while bushes of the same height in the vicinity, where the soil was of an average type, escaped without any injury at all.

Before proceeding to the next point, it may be noticed here that, other things being equal, the injurious effects of frosts are greater, the further they occur from the solstice, for the sun is then more powerful, and then, therefore, all the more rapid.

The dew-point or relative humidity of the air affects the greater or less sensibility of a plant to frost. The greater the relative humidity, the more intense the hoar frost, and hence the severer its effects on vegetation. This is why the ravages of frost, along river banks, in swampy ground, and in low-lying

situations, generally are greater than in other localities, and why small bushes and the lower branches of trees are frost-bitten, when tall poles and the higher branches are either not affected at all, or are affected relatively only to a slight extent. When fogs prevail, the destructive effects of frost are clearly defined by a line coinciding with the height of the fogs. On elevated ground, solitary teak trees, 20 feet high, may resist as low a temperature as 21° Fah. without showing a single frost-bitten leaf, whereas in low, moist situations all the leaves, and many of the young shoots and buds, would be killed by a temperature of 25° Fah. In India one of the causes of the greater severity of early frosts is the greater saturation of the air owing to the proximity of the monsoon just past.

Captain Losack has recorded that fire conservancy tends to heighten the susceptibility of forest trees to frost. It would be interesting to know whether the experience of other forest officers coincides with that of Captain Losack. Any opinion on the subject can be valuable only on the indispensable condition of long and continued acquaintance with the forests concerned, which must have been protected from fire for a sufficient number of years to allow of the comparative severity of successive winters being fully considered in deciding the question at issue. For instance the past two winters in the Central Provinces have been exceptionally severe. I do not believe as low degrees of cold have ever been registered before, since meteorological observations have been regularly taken and recorded here. It would, therefore, be unfair to charge to fire conservancy the greater destructiveness of the frosts of 1878-79 and 1879-80. Of course there is no *a priori* objection against Captain Losack's conclusion regarding this subject. Indeed it is quite possible that the increased humidity, both of the soil and atmosphere, due to successful fire conservancy, does, by raising the dew-point and producing more generous growth, aggravate the injurious effects of frost. But, on the other hand, enhanced vegetative vigour signifies more cover, and, therefore, greater impediment to radiation, the most energetic as well as the most rapid cause of fall of temperature. I myself can offer no opinion on the subject, as my longest acquaintance with a fire-conserved forest extends over only five years, and I do not possess sufficient data to draw any inference of greater value than mere guess-work. This much I can say with certainty, that during neither of the two past winters, unexceptionally severe though they were, did I observe that the vegetation in the fire-conserved forests suffered more than in the adjoining private or Government non-conserved forests.

My observations seem to me to tend towards establishing the general proposition that, with deciduous trees, early leaf-shedding is directly connected with the sensitiveness of the leaves themselves to early frosts. The *Bomwellia thurifera*, *Odina Wodier*,

Bombax malabaricum, and *Sterculia urens* are among the very first to shed their leaves, and they show most conspicuously of all the injurious effects of frost. Of course there are other causes, as shown above, which operate to render them extremely sensitive to low temperatures. For instance, the first three species are rich in sap, while the *Bombax* has also, with the *Sterculia*, large leaves. But that early leaf-shedding has some connection with the marked manner in which these trees bear evidence of the effects of frost, will, I think, be admitted from what follows. On the 19th November 1879, the thermometer fell to 19°Fah.; nevertheless numerous *Butea frondosa* trees, from 25 feet to 30 feet high, showed few signs of frost bite. On the 6th and 7th December following, the minimum temperatures were respectively 21° and 23°, i.e., from two to four degrees higher than on the 19th November, and yet the *Butea* suffered on those two nights, or rather mornings, more than on the latter date. Again, on the 25th, 26th, 27th and 28th January 1880, the lowest temperatures were respectively 21°, 22°, 25° and 28½°Fah., i.e., the temperature on those days was from 2° to 7½° warmer than on the 19th November, and for the first two days about the same as on the 6th and 7th December, and higher by several degrees on the two succeeding dates, and yet the effects of these last-mentioned frosts on the *Butea* were much more marked than those of the preceding severer ones. Whether this greater susceptibility of the leaves is due to their diminished vitality, and, therefore, lessened recuperative power as the time for shedding approaches, although a likely explanation, can only be, for the present, a matter of conjecture. The fact is there clear and indisputable. Other species, as far as I have observed, have behaved similarly, though not in so marked a manner as the *Butea*. The *Zizyphus* and *Celastrus senegalensis* may be quoted as instances out of a number.

(To be continued.)

A Submarine Forest at Bombay.

IN 1878, when excavations were made on the east side of the Bombay Island for the Prince's Dock, the Engineers found stumps of trees at a level of 12 feet and more, below extreme low-tide mark, proving a considerable subsidence of the land on that side of the Bombay Island. An account of this remarkable discovery was published in their Records for 1878, by the Geological Survey, with a note by Mr. W. T. Blanford, which we reproduce below. But it will doubtless interest the readers of the "INDIAN FORESTER" to have some details relating to a subject which has a special interest for foresters. These details have been extracted chiefly from a late report by Mr. Ormiston, the Resident Engineer of the Bombay Port Trust.

The bottom of the dock is 45 feet below the B. M. Stone at the Bombay Town Hall, the surface being about 21 feet below that mark, and nearly 2 feet below mean water level.

The excavation has opened out five distinct strata, the lowest of which is a rock with an extremely uneven surface. The rock (probably trap, though this is not stated in the report) was in places covered by moorum, and this by black loam. The black loam was overlaid by a stratum of stiff blue clay from 6 to 20 feet thick. The surface of this blue clay was nearly level, and the remains of branches, twigs, and reeds are distinctly traceable in it. The uppermost stratum was soft black clay or silt. The trees were growing, on an uneven surface on the rock, and some on the moorum and black loam overlying the rock. The soil was generally very scanty, often not more than four to six inches thick, and the roots were spread out almost at right angles to the trunk. In some of the fissures of the rock there was black muddy loam, possibly the remains of decayed roots. Altogether 382 trees were found. They varied considerably in length and thickness, but appeared to be of contemporaneous growth—223 were standing upright, and 159 had fallen. The largest tree was 4 feet 8 inches (according to the latest report 36 inches only) in girth and 46 feet in length; this was found on its side. Several others of equal girth were standing upright, but the upright trees were all broken off near the surface of the blue clay. The trees were standing at different levels, the highest being at low water level of extreme spring tides, while the lowest was 16 feet below low water level. Some of the forest in the Sundarbans is not much higher than the low water level of spring tides. But this forest evidently had a character different from the Mangrove and Sundri Forest on the deep mud of the Sundarbans. These trees had grown on rock, or on the scanty soil overlying that rock, and the forest probably stood above high water level. The difference at Bombay between low and high water, at extreme spring tides, is 16·60 feet, so that the subsidence, as indicated by the position of the trees, must have been more than 32 feet. The stumps which protruded through the blue clay into the silt were completely riddled to a short distance into the blue clay by the perforations of the *Teredo navalis* or another similarly destructive animal. Lower down, the holes became fewer, and many of the trees, when cut through into blocks, showed a single hole winding towards the roots, and getting larger as it approached the foot of the tree.

Of the trees found lying down, some must have drifted as they were without branches or roots. The large fallen down tree, mentioned above, had left a complete cast of its branches in the blue clay, though the woody matter was gone.

Apparently all the trees were of the same kind, except two, which it is said looked like teak trees. The wood of the others is described as fine grained, and dark like rosewood.*

No certain remains of any kind were found which might have indicated human habitation; nor were any shells or other organic objects discovered in the blue clay or the ground underneath it, except one oyster shell which was imbedded in some gravel in a crevice of the underlying rock.

But it is mentioned that traces of twigs and seeds were noticed, the latter having left impressions of their shapes in the blue clay, a fine film at the outside skin in some cases adhering to the clay. None of the casts were more than half an inch wide, but they were found close together, and in a vertical position.

Below the places where these casts of seeds were traced, it is mentioned, that the loam stratum was perforated with holes like rat holes, and that these were filled with very fine clay nearly as fluid as cream. Some of the holes commenced from the surface of the loam, penetrating it for the length of a foot; others ran in a horizontal direction.

The area excavated is about 30 acres; thus there were, on an average, seven trees per acre standing. But in addition to these, some of the fallen trees had probably grown on the spot. The trees were not, however, equally distributed, but were found grouped in large clusters on a portion only of the area.

Leaving to the geologist the further discussion of this most remarkable discovery, it will be well here to offer a few remarks which may be of interest to our readers. So much seems clear, that, after the land on which the trees grew had subsided below the sea, a deposit of clay, gradually and slowly, settled down upon the trees, and that at a later period a second deposit coming from another source, and consisting of soft silt followed.

The trees were probably killed by continued immersion in water. Soon after they had been killed, and before the deposit of stiff clay had settled around them, they were broken, and blown down by winds and waves. From what is stated in the reports which have furnished the data for these notes, it would seem that the wood is in no way petrified, but has preserved its character in a remarkable manner. It would be well to examine the structure of the wood found, and to compare it with that of Indian woods of the present day,

* We have received specimens of two kinds of wood: the first is rotten and has lost nearly all trace of structure, but the characteristic odour as well as the colour and texture proclaim it to be unmistakably 'Teak'; the second is sound and good and is a hard dark red wood which in structure corresponds with 'Khair' (*Acacia catechu*). The darker colour is probably the result of its long sojourn in the mud.—Ed.

in order to identify them, and determine whether they belong to families which are extinct, or are still found in India.

2nd September 1880.

D. B.

NOTE BY MR. BLANFORD.—This discovery of trees, in the spot on which they grew, below low-water mark in Bombay Island, is chiefly remarkable, because it shows that, in recent or sub-recent times, depression must have taken place in the immediate neighbourhood or ground which appears to have been raised. The Prince's Dock is on the eastern or harbour side of Bombay Island, and the Esplanade surrounding the fort on the western side, not a mile away from the dock, is composed of the rock called littoral concrete by Dr. Buist, a mass of shells, corals and sand, cemented together by carbonate of lime. It is scarcely possible that the materials of which this rock consists can have been accumulated at their present elevation above the sea; in all probability they formed, when first deposited, a sand bank or beach not raised above high-water mark, and as it is difficult to understand how elevation and depression can have occurred simultaneously on different sides of so small an area as Bombay Island, it is probable that the whole area has undergone elevation and depression alternately. If the elevation be the older movement, then the Esplanade must once have been several feet higher than it now is; if the depression is older, the trees at Prince's Dock have been at a greater depth beneath the sea than they now are. The former is perhaps more probable.

That such alternate movements of elevation and depression have taken place in Bombay Island, was shewn by Dr. Buist many years ago, though to a smaller extent than now appears probable. At the same time, before the depth to which depression has extended in this case, can be estimated, it is necessary to ascertain what kinds of trees are represented. If they be such as grow on land, the depression must have been greater than if they belong to such forms as *Avicennia* or *Bruguiera*, which grow some feet below high-water mark. The circumstance that the trees are bored by *Teredo* is in favour on their having grown in salt marsh, where these mollusca are peculiarly abundant.

A visit to Mount Faron near Toulon, France.

WHILST on a tour in the south of France, I did not of course omit the opportunity of visiting the famous Mount Faron, about which we have heard a good deal from time to time. Full details of this interesting reboisement work are to be found in the Forest Conference Report of 1874, but a few particulars of my own observations may interest some of the readers of the "INDIAN FORESTER." Not having been fortunate enough to find any one thoroughly well acquainted with the progress of the works during my short visit, allowance must be made for the incomplete information obtained. This mountain forms what may be called the centre part of a range of hills of magnesian limestone, which stretches along the north of Toulon, and presents a very desolate and forbidding appearance as far as show of vegetation goes, so that on the whole, it struck me as being of as dry and barren a nature as any of the arid hills of Rajputana or the Punjab.

Although a good deal has been said about the dangers of denuding a mountain of this kind, still, on the whole, the risks are not half so great as in the case of the black marl hills of the *Hautes* and *Basses Alpes*, for the hill being composed of hard limestone, the formation of mud and boulder torrents, with attendant landslips, &c., cannot occur.

Although considerable damage to cultivation has resulted from the felling of the forests on the slopes of this mountain, it is rather too much to say, I think, that the harbour roads were

obstructed by the "debris," &c., or that the hill consists of a mass of rolling stones as the descriptions would lead one to believe.

The area submitted to reboisement treatment is about 365 hectares, the whole of which belongs to the Municipality of Toulon, but this mountain forming one of the principal points of the defences of Toulon, all forest operations are subject to certain military rules and regulations.

The average rainfall is about 28½ inches, which is much above the average of that of most of the drier parts of India where works of a similar nature have been undertaken; besides, the proximity of the sea must necessarily render the atmosphere extremely moist. There is also a considerable fall of dew, and although the climate is decidedly hot for Europe, and droughts frequent, yet taking everything into consideration, the heat and dryness are nothing like that of Rajputana or Northern India.

Judging from some single trees and patches of the ancient forest still apparent, the natural vegetation seems to have consisted principally of Scotch fir and Maritime pine; and considerable areas of forest composed of these species still exist in other parts of the range.

The undergrowth consists principally of broom, juniper, brambles, and several kinds of oaks; but owing to the fact that seeds of all kinds of plants were sown on this mountain, when operations were first commenced, many strange shrubs and bushes are now to be seen, and form quite a study for the botanist. This tract has now been subject to the strictest conservancy rules for upwards of 27 years; and, as the portion belonging to the town of Toulon at least had been reduced to a complete state of barrenness, and, therefore, hardly capable of affording any grazing whatever, there could not have been much trouble in inducing the neighbouring inhabitants to give up their grazing rights. Besides this, they are said to have for many years abandoned the custom of keeping large flocks, and confined themselves to the cultivation of vines, olives and figs, which was found to be much more profitable.

The difficulties encountered in some parts of India, when grazing is to be excluded from certain reserved tracts, in the neighbourhood of which the principal source of welfare of the inhabitants consists in keeping large flocks of sheep and goats, is well known; and no comparison is admissible between the success of the exclusion of cattle from Mount Faron, and similar attempts in India, especially when the inhabitants in the neighbourhood are, in some cases, only half civilized, and altogether incapable of understanding anything but the actual loss of their grazing, even though none in reality exists.

I must confess, however, that I was rather disappointed with the show of natural vegetation, represented by 27 years

conservation, and could point out several tracts in various parts of India, which, when taken in hand, were probably equally barren, and where, notwithstanding the great difficulties of keeping out cattle, now exhibit a much better natural growth, even after five or six years conservation only. The principal method employed for effecting the reboisement of this tract has been by means of sowings in pits dug about 0·80 to 1·00 metres in depth, all the available soil being collected at the bottom.

This, on an average, left an empty space of about 0·50 centimetres, which had the advantage of giving the young plants a certain amount of shelter during their early growth.

Owing to the very hard rocky nature of the soil, which necessitated the digging or rather quarrying out of the pits at those places when there was a likelihood of encountering fissures in the rock, the pits are very irregularly distributed over the surface, but, as a rule, they are placed from three to five metres apart.

Most of the pits are filled with strong plants of Aleppo pine, Maritime pine, Holm oak (*Q. ilex*); Acacia (*Robinia*), &c., of all ages, as the sowings often failed, and had to be executed over and over again. About five per cent. of the pits are empty, the rock having proved too compact to allow the roots to penetrate. Planting with strong plants would undoubtedly have succeeded better, but when sowing was found to answer, and being at the same time less expensive, it was naturally finally adopted.

Some of the trees of the older plantations are now from 15 to 20 feet high, and seem to be in a most flourishing state, with the ground underneath well covered with humus. Nearly the whole area has now been completed, with the exception of the parts situated in the immediate neighbourhood of the fortifications, and on the side next Toulon where the ground is for the most part precipitous.

The cost of these works is said to have amounted to about 100 francs per acre, which is much less than the expenditure on other reboisement operations in the Hautes and Basses Alpes, and where the cost has amounted, in some cases, to as much as 350 francs per acre; but it must be recollected that in the case of Mount Faron no masonry weirs or other works of an expensive nature have been constructed.

The planting of resinous trees seems to have been intended originally as a transitory species, to be replaced eventually by deciduous trees, suitable for coppicing, when it became necessary to clear portions of the forest for military operations; but however good the theory, the idea has not been found altogether practicable, as it appears that pines only will grow on the hard limestone rock.

All attempts at planting larch, cedar, eucalyptus, &c., have naturally failed. Although the reboisement of Mount Faron has been an undoubted success, and has been executed

apparently at a very moderate cost, still it must be recollected that, on the whole, the conditions of rainfall, climate, experience, skilled labour, supervision, &c., are much more favourable than in the case of any similar works undertaken in India.

It may be argued that in India there are certain species of trees capable of withstanding long droughts and excessive heat for a much longer period than any European species, which must of course be admitted; but, on the whole, I think it must be allowed that the conditions are decidedly very much in favour of the success of the Mount Faron operations, even though the conditions are perhaps as unfavourable as can be found in Europe.

E. M^{OR}A. MOIR.

Precautions to be taken in felling trees singly in dense forests.

WHEN a tree is to be felled in a well-stocked forest, it is most important to preserve the neighbouring trees and young tender seedlings from injury.

I have invariably noticed that by the careless felling of trees, especially by private purchasers, many young seedlings and trees of immature growth are broken down by the fall of a big tree, and die in consequence.

It is necessary, therefore, when a tree is to be felled, first for us to determine in which direction there are fewest seedlings and trees, for in that direction the tree ought to be felled; and, accordingly, I would suggest that the departmental mark be placed on the tree on that side.

It would be necessary to impress upon the wood-cutter that, whichever side of the tree bears the departmental mark, in that direction the tree must be felled.

If the tree has many large branches, these as well as all creepers, should be cut down before felling the tree; and instructions should be given at what height the tree is to be cut. If it is settled that the tree is to be cut at two feet from the ground, the wood-cutter must be carefully instructed first to cut the tree with the axe very deep on that side of the tree to which it is intended to fell, and about nine inches lower than the cut to be made on the opposite side of the tree. When the tree has been cut on both sides, and about three parts through, then the remaining portion should be cut by the saw on the opposite side or back of the tree, which will then come down straight in the direction intended.

The above method in felling trees has been tried, and the result found almost certain. And by insisting on this method being carefully used, the wood-cutter may rescue the lives of many valuable seedlings.

S. C. CHUCKERBUTTY.

Forests and Arboricultural Work in Queensland.

WE have received from Mr. L. A. Bernays, the Vice President of the Queensland Acclimatization Society, a copy of the Society's Report for 1879, together with a paper by himself on the subject of Economic Tropical Horticulture in Northern Queensland.

From these papers it appears that the Society, though poor, and supported by the meagre Government grant of £500, is doing a great deal of good work for the colony, not only in acclimatizing useful exotic animals and plants, but also in furthering the development of indigenous products, and even the preservation and conservation of the forests. On the subject of forest conservancy we quote as follows :—

"Having been desired by you, verbally, to make any observations in my power, which might assist in dealing, hereafter, with the question of Forest Conservancy, I lost no opportunity of comparing my own views upon the subject with those of many intelligent persons engaged in various ways in timber-getting. There can be no question that the subject is one of extreme importance to the future of the colony ; and the fact that we have still enormous tracts of timbered country, affords facilities for dealing successfully with the question, inasmuch as, if now systematically and intelligently handled, the costly and difficult phase of replanting need never arise.

"Further experience has induced me materially to modify the views expressed to the Government in 1871, when I was honored by an invitation to make suggestions for a Forest Conservancy system. I am now quite satisfied that no really practical good can be effected until the Government are prepared to appoint departmental officers of various grades, whose duties shall be *solely* confined to regulating and guarding the felling of the natural timbers, and the creation and preservation of timber reserves. The example of India abundantly proves that this may not only be accomplished without being a charge upon the State, but that such a department, properly worked, may be made a source of revenue. Gazette notifications upon the subject of felling timber are of no practical effect unless the orders of Government are enforced ; while to do this effectually, the officers charged with the duty should not have their attention distracted by the imposition of other incongruous duties. The Indian Forest Department is so admirably organised, and its success has been so marked, as to indicate it as an excellent type on which to found a department of our own ; and there is little doubt that the Government of India would willingly lend to the Queensland Government, a competent officer to examine our forests, and to prepare a scheme for their management and preservation. The expense of this preliminary step would not be great, nor need it com-

mit the Government as to their course of further procedure, while it is more than probable that a plan would be devised under which a Forest Department could be made, at the least self-supporting, and, in course of time, even a source of revenue."

And from these remarks it is clear that if forest conservancy is attempted in Queensland, it will be on broader principles, and on a more generally correct basis than the work in South Australia, which we reviewed in our last number.

On the subject of the *Cedar Forests* (*Cedrela*) we quote as follows:—

"In the meanwhile, as our rich cedar forests are all too rapidly disappearing, a preliminary step might, with advantage, be taken by the issue of a memorandum to the various persons engaged in the cedar trade, inviting suggestions from them for regulations, which, while not needlessly repressing the industry, would prevent much of the heedless felling of this valuable timber, which, despite existing regulations, is now undoubtedly going on. From conversation with many persons, both masters and men, engaged in the trade, I find every disposition to submit to the enforcement of reasonable regulations for this object."

But we hope the Queensland Government will not waste more time in inviting opinions, but set to work in earnest in demarcation.

Mr. Bernays' report gives an interesting list of exotic trees successfully introduced into the colony, and mentions that many Indian trees, especially teak, thrive admirably. We wish the Society every success, and hope that some good practical results will follow their recommendation of Forest Conservancy.

Technical Terms of Forest Economy.

TO THE EDITOR OF THE "INDIAN FORESTER."

SIR,—I should be much obliged if any one would assist me, in any way they may be able, to acquire a knowledge of the technical terms used in India, England, Canada, or other countries where the English language is spoken. If the corresponding French term were added, it would be of great assistance to me, by enabling me better to understand the significance of the English term given.

Of course the definition, referring to the subject expressed by the given term, should be added, in English. And I may here offer a suggestion, which is, that the editor should publish in the "INDIAN FORESTER" any suggested rendering of French or German terms which may be sent to him, together with a concise and correct definition. And further, he might himself propose a certain number of the technical terms of France or

Germany, inviting forest officers to send in English renderings and definitions for publication. This would be a good exercise for all of us, and would oblige us to refer to our books, and prevent our forgetting former studies. The definition given by each would enable the editor to judge if the contributor had properly understood the meaning of the foreign term which he had proposed for rendering. A column for the editor's remarks would enable him to give his opinion respecting each. None should be omitted, as it would be for the majority to adopt the rendered term, or the definition which should be most generally acceptable.

In the days when forests were of greater importance in England than they are at present, I feel sure books must have been written containing many terms which would be of great service now, perhaps in a modified sense, as renderings for the technical terms of France or Germany which many, no doubt, who have studied in those countries, find it difficult to express in our mother tongue.

We should most likely find, in some old books, the names given to high forest at its different stages of growth, and doubtless many other useful terms besides.

Some time ago, having seen in a blue-book (containing a collection of official papers on Forest Administration in India), a suggestion that a hand-book of information, relating to the Crown forests and woodlands in England should be compiled, had been communicated to the Commissioners of Her Majesty's Woods and Forests, Whitehall, by Mr. Herman Merivale, C.B., in April 1870, and that in reply it had been stated that the work would probably be ready at no distant date, I wrote to enquire if the work had been compiled, and, if so, where it might be obtained. But I was informed that the work had not been undertaken.

The subject of forest terminology was taken up at a forest conference some time ago, and I have a copy of the pamphlet then printed.

I hoped to be able to learn much from Messrs. Smythies and Fernandez' translation of the *Manuel de Sylviculture*, by M. Bagneris, and I applied for a copy or two of the 2nd edition, but I believe it has not yet been brought out.

Much might be done by forest officers at home on leave, if they were to look up information on this subject in the library of the British Museum, or other good library.

Perhaps the Government would consent to call upon the librarian of the British Museum for a list of any books which might serve as books of reference in matters in any way connected with forests or the chase. The list might be published in the "INDIAN FORESTER," and then any officer going home on leave would have no difficulty (if he had inclination and opportunity) in obtaining any book mentioned in the list.

Perhaps also the Government might be induced to order the publication of the handbooks above referred to, which was suggested by Mr. Leeds.

Without some such assistance in this matter, forest terminology, and in like manner forest conservancy, will make but slow progress. As it is, forest officers appear to be diffident in writing on subjects connected with forest conservancy, doubtless finding it, as I do, difficult to express themselves concisely and intelligibly. Yet in so large a country as India, writing is our best means of exchanging ideas and communicating our experiences. Without such interchange and communication, much valuable experience will be lost or confined to narrow limits.

We all know the maxim that *time is money*. I remember having seen this adage blazoned in gold letters above a church clock, a quaint place to inscribe it, in a small French town, I believe it was at Barcelonnette. It was written in English, and perhaps the majority of the inhabitants did not understand it, for theirs was anything but a busy, bustling, money-getting community.

But we Englishmen understand the maxim well, and I think it is applicable in the present instance.

Forest terminology cannot be studied without one's learning something about forest economy, and that with a very clear perception, if the definitions of the terms are precise. The sooner a knowledge of the subject is generally acquired, the sooner we shall be able to introduce careful working plans, such as are applied in France and Germany. These working plans we are at present obliged to make very simple and incomplete, because insufficient knowledge would prevent the proper execution of scientific working plans by the officers who would have to be entrusted with their practical working. Thus our administration tends towards the extraction of timber more than towards progressive amelioration of the forests entrusted to us. Yet scientific working plans alone can secure the triple object of forest conservancy, viz., to keep up the yield of the forests, to renew them simply, by the aid of Nature's own action, without costly plantations, and to continue to improve them to the utmost, without imposing inordinate expense or sacrifice upon the present generation for the profit of futurity.

The attainment of these ends will ensure a great money advantage to the Government, and to the country at large; and, in endeavouring to bring them about, let us remember that, whenever haste will not compromise them, time is money.

HARD CASH.

Relation between the weight and contents of stacked fuel.

TO THE EDITOR OF THE "INDIAN FORESTER."

DEAR SIR,—Will not some of your readers, who have charge of fuel works, undertake an experiment to determine the relation existing between stacked fuel and its solid contents? Surely at Changa Manga, or in Nimar, or at some of the hill stations, such an experiment would present no difficulties. The experiment conducted by me at Chakrata in 1873 was only a commencement, and we require more extended observations before we can come to a definite conclusion.

A. SMYTHIES.

Firewood and its cost of extraction from Jaunsar Forests.

TO THE EDITOR OF THE "INDIAN FORESTER."

SIR,—The following particulars regarding the rates paid for cutting and carriage of firewood in the Jaunsar Division may be of interest to some of your readers:—

Our unit of measurement is 100 cubic feet stacked. One stack of fuel in the forest is 20 feet long, 5 feet high, and 2 feet broad, the fuel being sawn up into 2-foot length. For felling, cutting, and stacking we pay Rs. 2 per 100 cubic feet, that is, Rs. 4 per stack, no matter whether the fuel is oak or fir. There is also 5 per cent. commission to be paid to the contractors, which comes to one anna seven pie per 100 cubic feet.

For carriage we pay Rs. 1-8 per 100 cubic feet of oak per mile, and Rs. 1-4 per 100 cubic feet of fir. There is also 5 per cent. commission on these rates, which brings them up to Rs. 1-3, Rs.2-4 for oak, and Rs. 1-5-0 for fir.

For stacking in the sale depôt we pay 5 annas per 100 cubic feet.

Let us now consider the cost of bringing 100 cubic feet of either kind of fuel from the forest to the sale depôt, at distances of five and ten miles—

1st.—From a distance of five miles.

		Oak.			Fir.		
		Rs.	As.	P.	Rs.	As.	P.
Cutting in forest	...	2	1	7	2	1	7
Carriage	...	7	14	0	6	3	0
Stacking in depôt	...	0	5	0	0	5	0
Total Rs.	...	10	4	7	8	15	7

2nd.—From a distance of ten miles.

		Oak.			Fir.		
		Rs.	As.	P.	Rs.	As.	P.
Cutting in forest	...	2	1	7	2	1	7
Carriage	...	15	12	0	13	2	0
Stacking in depôt	...	0	5	0	0	5	0
Total Rs.		18	2	7	15	8	7

As some people still believe that the *maund* is a better unit than a cubic foot (whether stacked or solid), we will convert the above rates into the cost per 100 maunds, taking 250 cubic feet stacked oak, or 330 cubic feet fir, as the equivalent of 100 maunds. Accordingly we find that in the first case 100 maunds of oak cost Rs. 25-11-6, and of fir Rs. 23-8-11, and in the second case the cost of the former is Rs. 45-6-6, and of the latter Rs. 51-4-4.

The above only represents the actual cost, and nothing is included for road-making and road repairs, establishment, &c.

10th July 1880.

A. SMYTHIES.

The Changa-Manga Working Plan.

TO THE EDITOR OF THE "INDIAN FORESTER."

SIR,—In your last number a question was asked whether, after the "flourish of trumpets" that had been made about the Changa-Manga Plantation Working Plan, its calculations had not been proved to "be all wrong by the stern logic of facts."

I do not know what your correspondent's object was, whether to call the forest officers concerned to task for boasting of their work, or to show that working plans generally should be discouraged; but if the former, as I was for some years Conservator, and it was under my direction that the working plan was undertaken by Mr. B. Ribbentrop, I should be indeed ashamed if any "flourish of trumpets" was ever made; and I shall be obliged if your correspondent will quote any such passage in any report, either of mine or of any one under my control. If, indeed, your correspondent means that allusions have been made to the advantages of a regular plan,—that I have repeated, in season and out of season, the same old story, "work by a definite plan; it saves money; it ensures order; it alone secures the accumulation of data which is what we are sorely in want of"—then I am glad to admit that such remarks may be found in plenty. In India especially, for every new idea, it is necessary to repeat, to enforce, and to repeat again, the same thing, till people get accustomed to it; then the thing will at last get accepted as a recognized fact. But surely this is not boasting. Before

the working plan (which is hardly a working plan, but a "cultivation plan" for a forest *to be*) was made, a good deal of money had been spent to no purpose. A plot here and a plot there was experimented on, and sowing done over and over again. No scheme of operations could either be estimated or sanctioned. No one had any idea what they were going to do; no notes were kept as to methods followed, and results attained. There was a dispute regularly renewed every year with the canal department as to what area had been watered, and how often. The work, in fact, took its chance under the influences and orders of the moment. To put a stop to this, I consulted with Mr. Ribbentrop, and that gentleman at once proposed a regular plan of operations. The whole area was surveyed and levelled, the capabilities of each plot for watering were ascertained, the soil was described, and the whole area (up to the limit then thought desirable) laid out with roads and cultivation compartments properly numbered and marked on the ground.

Nurseries were properly distributed, and thenceforth the plantation work proceeded in an orderly way. "Control-books" were opened; and though (under difficulties which always will occur in new undertakings, change of officers, novelty of the practice, and so forth) these books have not always been kept up as they should have been, still a more or less complete detail of all expenditure, and all other material results, has been made available. The cultivation on known methods, and at an ascertained cost, has been provided for year by year in a sanctioned estimate, and as far as the work of first stocking has gone—now to over 7,000 acres—it has been very successful. If such results show that it was useless making a working plan, or if such a case may not be used as a text to point remarks urging the working on definite plans in other places also, I have nothing further to say.

But what is meant also is, that our calculations as to the total amount of material to be available for cutting at the end of ten years (the chosen period of rotation) are all wrong.

Now, if this objection had been urged in a German or a French forest of oak or beech, where tables of growth-rates and all other *data*, as accurate as generations of observation and experience can make them, are in existence, it would of course be utterly condemnatory. But could any one possibly suppose that *any* calculation, however cautious, made for the first time on a new soil, with an almost unknown species,* and on limited data, would prove to be so correct as to enable us to build positive conclusions on it? I may possibly incur some blame for admitting that the conclusions *have* been proved wrong, for the year of cutting has not come: but still I think that *owing to*

* I mean of course, unknown as regards its rate of growth; wholly unknown too as to how it would behave in "bar" soil with canal irrigation.

a very great difference between the conditions assumed for the calculations, and those really found to exist, it is extremely probable that if the total area named to be cut on the completion of a ten years' rotation, were actually cut, while individual compartments closely responded to the tables, the outturn would, on the whole, be very considerably less than the calculation. But is this, I repeat, a matter of wonder, in a plantation where the data for calculation were slender, and where certain conditions were expressly postulated, which conditions have proved impossible of realization?

The real objection no doubt would be—why did you make calculations at all? I answer that they were made partly because Government would always insist on it, and partly because it was known to everyone acquainted even with the elements of forest management, that such calculations would only (in our then stage of attainments) be looked on as an interesting exercise, and would be useful as indicating to learners the *form* and *method* adopted in making such calculations. No one expected them to prove absolutely correct. Moreover it was necessary, in order to obtain sanction, to show some estimate of results. The calculations showed what may be indeed an excessive estimate, but what sufficed, even if the results were reduced 40 per cent., to justify the undertaking. So that with these objects the tables of estimated yield were drawn up. They were based on the only *data* available, a certain canal belt of known age and certain sample areas. I can only offer it as an opinion, but I think still that it is not so much the calculations that are erroneous, but that the conditions assumed as necessary for those results have not been attained, and this could not be foreseen.

In the first place, a fairly regular supply of canal water was assumed; in fact, the supply has been most irregular, and has, over extensive areas, caused a danger of actual failure, and a retardation of growth sufficient to upset any calculation. It is natural that canal officers should care much more to extend their revenue by taking off water-courses to distant corn fields than to save the Government plantation, but we were hardly prepared for the harshness with which rules were in some cases made and enforced for keeping water out of the plantation. In the next place, it was supposed that on the deep and uniform, and rather stiff soil of the edge of the "bar," water could be dispensed with after a certain number of years' continuous irrigation. Whether owing to the earlier years' watering not having been sufficient or sufficiently continuous, it is now found that water cannot be altogether dispensed with. The older growth, indeed, requires comparatively little, but the rainfall is so scanty and uncertain that an artificial flooding once a season (or even oftener) is found indispensable, at least

up to the age of nine or ten years, which is, of course, all we have as yet experience of in this locality.

It was also assumed, I think—I write entirely from memory—that forty “stores” or standard trees might be left for timber growth on each acre cut over. It is now known that this number will effectually prevent coppicing of the stools which result from the cutting.

There are also grave doubts whether in the dry soil of the “bar,” and under the precarious water conditions, shisham will, as a *rule*, coppice successfully enough to make a treatment as “coppice” or “stored-coppice” possible. The plan will probably be revised, and a modified treatment with a longer rotation, for the shisham, proposed. I think most officers are agreed that the greatest *desideratum* is to get a large proportion of evergreen growth introduced into the almost pure “shisham.” The *Tamarix articulata* is an evergreen, but it is of course looked upon rather askance, on account of its (real or alleged) low attainments in the scale of value.

To resume briefly: I think then that any candid observer must regard the starting of a “working plan” as of the utmost necessity, and as of proved value, and must admit that the calculations of growth were a purely subsidiary part of it; but the fact that on the first period running out, a thorough revision of the plan will be necessary, is no more than what one would expect in the first working plan of any Indian forest, and that this does not in the least show either that the plantation of the ‘bar’ tract was a failure, or that laying down a working plan was unadvisable.

It may still be urged that the plan should have directed cultivation, but not entered into calculations of future yield.

I reply that the calculations, as far as any forest objects are concerned, were made chiefly as a learner’s exercise, as affording excellent practice in measuring, counting, and so forth. Unless a beginning is made even with data that are far from perfect, it is impossible to accumulate materials and observations for future improved calculation. If the “wrong calculations” now complained of had never been put into form, I doubt whether any notes and trial measurements would have been made at all, or any materials got together for ultimately correct conclusions. If GALILEO had declined making observations with the wretched telescope he possessed, and had insisted on recording nothing till he had a twenty-inch object glass to work with, I am afraid astronomical progress would not have been as satisfactory as it has been. Infinitely more knowledge will be gained by revising the existing working plan, and correcting the confessedly tentative calculations of yield, seeing where and how they were wrong,—than if we, having carefully omitted up to 1881 to calculate any sort of estimate, were then to set to

work for the first time to make a calculation of yield. It is much better to make an imperfect estimate, and correct it gradually, than to wait and do nothing till perfect data "come down from on high."

But that there should be any *boasting* about the future results based on such calculations is indeed unreasonable.

Yours, &c.,

B. H. BADEN-POWELL, C.S.,
Late Conservator of Forests.

The Forests of Cochin-China.

IN the July number of the *Revue des Eaux et Forêts* are published extracts from M. Bert's Report on the forests of Cochin-China. It is difficult to say what better we could have expected, but all the same M. Bert's Report does not seem to us to come up to the expectations we had formed after the fuss that was made about his visit to India, and the results that were expected from his inspections in Cochin-China. After going through these published extracts, it seems to us that it would not be worthwhile to translate the whole of the extracts, so we give, as shortly as possible, a sort of summary of their contents.

French Cochin-China consists of the delta of the Cambodia river and small portions of adjacent territory. It is chiefly alluvial soil, and has but few hills, and those on the Eastern frontier, the highest point being, it would seem, Nuibacten, 2,900 feet. The climate is tropical, the maximum temperature being about 95°, the minimum about 62°, and the mean of the year about 83°. The average rainfall is about 60 inches.

The forests cover an area of about 3,120 square miles, or 13·3 per cent. of the whole extent of the colony. The most important forests are on the eastern side of the colony, those of the river delta being, as usual, chiefly mangrove swamps. These forests may be classified in two ways: *first*, according to the nature of the species, into evergreen, deciduous, and mixed forests; and, *secondly*, which comes to much the same thing, according to locality, into coast forests, plains forests and hill forests.

The *coast forests* are again sub-divided into 'mangrove forests,' liable to the action of the tides, and composed chiefly of *Rhizophora*, *Bruguiera*, *Sonneratia acida*, and *Kandelia Rheedii*; and 'marsh forests' only occasionally inundated at very high tides, in which the principal trees are *Avicennia*, *Pongamia*, *Barringtonia racemosa*, and *Melaleuca Cajeputi*. The latter tree is called 'tram,' and in some of the western provinces is found growing gregariously in areas of considerable extent.

The *plains forests*, the chief trees in which are deciduous, consist principally of species of *Dipterocarpus*, *Shorea*, *Terminalia*, *Dalbergia cultrata* and *purpurea*, *Melanorrhæa usitata*, *Dillenia pentagyna*, *Careya* and *Buchanania*.

The *hill forests* contain a mixture of evergreen and deciduous trees, of which a long list is given, the principal ones being *Lagerstræmia*, *Pterocarpus*, *Diospyros*, *Artocarpus*, *Garcinia*, *Calophyllum*, *Hopea*, *Vateria*, *Xylia dolabrisformis*, *Mesua ferrea*, *Melia indica*, *Machilus* and *Butea*. Most of these trees have quick growth, reaching, at the age of 100 to 120 years, a girth of 5 to 7½ feet, and are consequently fit for felling at that age. M. Bert gives a useful table of the principal trees with their native names, season of flower and fruit bearing, maximum size, and the specific gravity of their timber, which we need not reproduce.

The forests of Cochin-China have, it appears, like those of many parts of India, suffered very extensively from jhum cultivation (called in Annamese 'rây'), from jungle fires, and from the system of working which has hitherto obtained, of cutting out one by one all the trees of good kinds to the general deterioration of the quality of the forest. Permit holders are restrained by only one rule, and that is the prohibition of felling trees of less girth than 2½ to 4½ feet according to species. The demand on the forests is not very considerable, except for the best kinds of building timber. Firewood and charcoal are only required in small quantities for the use of the large towns; a small quantity of timber merely is required for boat and cart-building, and of minor produce bamboos, wood oil, resins and wax are the most important articles of trade. So that it is only as regards large timber that there can be said to be an insufficient supply. Timber is taxed by Government at the high *ad valorem* rate of 25 per cent. on the market value, and the yearly revenue amounts to about the following amount:—

Timber	...	...	123,000 francs.
Permit fees	...	...	29,600 "
Minor produce	...	...	56,000 "
Total			208,600 "
Equivalent to			£8,340 "

No information is given regarding the expenditure, so we can gain no idea of the net yield of the Cochin-China forests.

The whole of the forests appear to be subject to very extensive 'rights' which are enjoyed by the surrounding population to the extent, that not only can they cut what they require

for domestic purposes, but they are also at liberty to cut and sell to the holders of permits. This is, however, much the same as in the forests of many parts of India, and certainly in the open forests of Chittagong.

The concluding paragraphs of these extracts from M. Bert's report go to show that what is now wanted is to restrict the fellings and to save from destruction by jhuming some of the forests. We presume M. Bert has recommended the formation of reserves, but on his recommendations and the probable future policy of the French Government in the management of its Cochin-China forests, the present extracts are unfortunately silent.

Deputation of an Indian Forest Officer to Mauritius.

SOME extracts from the letters of Mr. R. Thompson, Deputy Conservator of Forests, who is now engaged in examining and reporting on the forests of the Mauritius, may interest our readers. Mr. Thompson reached the Mauritius on April 29th, after a very disagreeable rough passage *via* Aden. In a letter to us he describes the forests as having been badly cut over, but little now remaining. The following is an extract from a letter to Dr. Brandis :—

“As regards the forests there are only a few of small extent remaining, and these in inaccessible places on the hill slopes. The Crown possesses but few valuable forests, each of small extent. Where not cut over the forests are of the tropical evergreen type, dense and moist, but here attaining no height. The average height is not more than 35 feet, though individual trees are to be met with towering above the rest of the forests to a height of 50 feet. *Sideroxylon grandiflorum* is the tallest tree I have yet seen, frequently attaining a girth of from 12 to 19 feet. There are upwards of 20 species of *Eugenia*. A very fine *Canarium Colophania* and several *Imbricaria* are also present. A beautiful tree *Calophyllum inophyllum* occurs in some tracts. Formerly it was more numerous, and occupied the ground nearer the Sea Coast; now it has been driven into the hilly regions. We have also some four or five species of *Diospyros*. Tree ferns are very numerous, and many attaining a height of 25 feet.

“Several introduced species have now become sub-spontaneous, and grow with intense vigour. They are fast invading every available space in the country, and are crowding into the original forests as fast as they can find room. Owing to this invasion, it will, I imagine, be a difficult question to decide what will be the best method of treatment for the existing aboriginal forests. As evergreens the forest to remain in a healthy condition must be cautiously treated to preserve the soil from

exposure and consequent deterioration. I have observed that wherever a tree, here or there, has been removed, numerous others have been killed by the action of the winds (which here are very strong), and the open space created has admitted a host of inferior introduced species. I would ask your advice on this question. It is one of the first questions of the day as regards the life of the few forests remaining to the colony.

"Apart from the indigenous evergreen forests, there has sprung up everywhere, where woods have been cleared, or the land allowed to fall out of cultivation, a dense growth of such species as *Tetranthera laurifolia* and *Tetranthera monopetala* with *Rubus moluccana*, which have taken firm hold of the soil. In the lower parts of the island, *Acacia leucocephala*, *Albizzia Lebbek* and others introduced from India and elsewhere are now the prevailing types.

"Several plantations have been formed of late years in which a great many of our useful Indian forest trees are now growing with great vigour, the teak excepted, the latter appearing to suffer from want of a free soil and sub-soil drainage. The existence of these plantations is of very great importance to the colony, as a number of hardy and rapid growing species have not only succeeded well, but they appear to have become naturalized likewise. On the whole, the island, considering how very great has been the destruction of its primeval forests by the extension of sugar cultivation, is extremely well wooded with low scrub jungle; and thus protection is afforded to the soil. These scrubs, if protected, would grow up into well-stocked forests, I have no doubt.

"The annual production of sugar is upwards of 30,000 tons. One-third of the area of the island is supposed to be under sugarcane cultivation. The island is extremely unhealthy, fever being the prevailing disease. It is so bad that all the low-lying country has been abandoned by the people who can afford it, and who are now living on the higher situations in the centre of the island.

"*Pinus longifolia* grows very well here. I would ask you kindly to tell me what other *pinus* we could usefully introduce into the colony, and whether you could suggest any other broad-leaved species for a climate such as we have here. On the higher parts of the island the annual rainfall is from 140 to 150 inches. The temperature is never higher than 80°, and never falls below 50°. There are of course strong winds, which blow from the south-east for upwards of eight months of the year. These winds are very trying to young trees."

And portions of Dr. Brandis' reply may not be without interest :—

"Besides *Pinus longifolia*, *Cupressus torulosa*, and the eastern pines, *P. Kasya* and *P. Merkusii*, of Indian species, the seed of the *Kasya* pine to be got from Assam, that of *Merkusii* from Burma, there is also *Pinus canariensis*, which has doubtless been introduced on the island already, and the seed of which can be got from nurserymen in England.

"You ask about the treatment of the natural evergreen forests, with reference to the introduced species, which you say are taking the place of the natural woods wherever a clearance is made.

"What you say reminds me of the Nilgiris, where the natural evergreen forests (sholas) have much diminished, and in their place forests of Australian *Eucalyptus* and *Acacia* have sprung up, which are much faster growing and much more useful than the original inhabitants of the plateau.

"What you should do I think is to review the different natural species, and to point out which of them are really valuable, either on account of their rapid growth or on account of their timber and other products. The growth of these should be encouraged. But you should also review the introduced species, which experience has shown to thrive well on the island, and point out those which are most valuable, because they spread readily, grow rapidly, and furnish good timber or other produce. And the growth of these should be encouraged by all means. Not only on the Nilgiris, but elsewhere also, has it been found that exotic trees often adapt themselves better to a country than the indigenous species.

"I have no very clear idea of the objects of Forest Administration in Mauritius if denudation has not progressed much; I understood formerly that it was chiefly the fear of denudation which had induced the Colonial Government to turn its attention to their forests. But what you say makes me think that these fears must have been exaggerated.

"Doubtless there is great demand for fuel, and I suppose that the 30,000 tons of cane sugar which are exported annually will consume a good deal of firewood. And some building wood is doubtless also wanted in the island, though the importation of teak from Burma is considerable.

"In any case it will be well for the Government to have as large an area of forest under their control as possible, and to this point you will doubtless chiefly direct your attention. I do not know whether it will be necessary to propose that Government should take the supervision of private forests."

(Since the above was written, Mr. Thomson has returned to India, and has kindly sent us a copy of his report which we hope to be able to review in our next number.—*Ed.*)

II. OFFICIAL PAPERS.

The Mohwa Tree in the Central Provinces :

Being an Extract from a letter from the Chief Commissioner of the Central Provinces, to the Government of India, dated the 25th June 1880.

THE Chief Commissioner believes that, as a general rule, the Mohwa tree is not destroyed by the people. It is too valuable for its produce to be cut down and sold as timber. Ordinarily, the trees cut down are those that have ceased to bear fruit. The diminution in Mohwa trees, over considerable areas, results from the enormous extension of cultivation there has been during the last fifteen or twenty years. They have disappeared in common with other forest trees. Of the Mohwa trees, however, many are left, and these are seen now in the midst of cultivation. Being valuable, they have been spared, when other trees have been cut down. But no seedlings grow up in the cultivation, and there are, therefore, no young trees.

It is the absence of young trees in localities such as described, recently reclaimed from jungle, that has largely generated the idea that the Mohwa is disappearing. When, in the course of years, cultivation encroaches on the forest, the Mohwa must disappear in common with other trees; but wanton destruction of this valuable tree is believed to be an altogether exceptional proceeding.

"With the view, however, of ensuring the preservation of the tree in village areas, the Chief Commissioner has included the Mohwa among trees which proprietors are prohibited from cutting down without sanction, and further circular (of 17th October 1879) instructions have been issued to all district officers, requiring that private owners should be encouraged "to propagate a tree the fruit of which, in a year of scarcity, is a valuable aid to the general food-supply of the country."

In forest tracts the production of Mohwa has, the Conservator reports, his special consideration; and his opinion is that there need be no "fear of any material diminution in the supply." The Mohwa being indigenous, the process of reproduction proceeds uninterruptedly and naturally in forest reserves, and, as a consequence, fruit-bearing trees must permanently cover extensive areas.

Orders of the Secretary of State on the Forest Reports for 1878-79.

IN the year to which these reports relate, the India Forest Act came into force, and steps were taken by the Forest Department for declaring forests reserved under the terms of that statute. The area of demarcated reserves on the 31st March is stated to have been 15,127 square miles, or a decrease of 3,986 square miles, compared with the figures given in the report for the preceding year. As a reason for this, it is explained in the Inspector-General's review that it was not found expedient to declare the whole of the forests reserved under the Act which had been thus declared under the former rules. I conclude, however, that the demarcation of reserves will be continued, and that in course of time considerable additions will be made to those already demarcated, for in the orders on the Bengal Report it is stated that the area of reserves in that Presidency was expected to be increased by over 50 per cent. during the past year.

In the Punjab the delay in legally settling the reserves is attributed to the weakness of the staff available for the work. The temporary increase of three Deputy and Assistant Conservators to that Province, reported in your letter, No. 29 of the 19th December last, will, I trust, prove sufficient for the present requirements of the Forest Department there, for it is important that the work of demarcating and settling reserves under the India Forest Act should be carried out with as little delay as possible.

The attempts at fire protection during the year have not been uniformly successful, but I am glad to see that this subject has received from your Government the attention which from its importance it deserves.

The financial results of the year have not been favourable. During the time when the whole available force of the Forest Department has been engaged on works of demarcation and improvement, it was hardly to be expected that the revenue should be maintained at a high average, but upon the completion of the most important of these works, more attention can be given to the development of the resources of the forests, and as soon as it is found practicable generally to resume girdling operations, and attention can be given to the development of the timber trade, the financial results of the administration of the State Forests will, I doubt not, speedily improve, and the benefits of the works undertaken for their improvement in recent years make themselves apparent.

Orders of the Secretary of State on the Budget Estimates of the Forest Department for 1880-81.

TAKEN as a whole, these estimates show a gradual falling-off in the net revenues of the Department, which appears to be the result of increased expenditure and diminishing receipts. The former is, no doubt, due to the greater attention that has of late years been given to the demarcation and improvement of forests, whilst the latter is to some extent accounted for by the stagnation of trade and the effects of the drought and scarcity which have, of late years, prevailed in certain provinces and districts. But, whilst giving due weight to these circumstances, I cannot but think that the diminishing returns to the State from this source of revenue must be in some measure due to defects in the administration of those provinces where the forest revenues have mostly decreased. It is, however, satisfactory to learn that in the Central Provinces, where the administration has been efficient and economical, the forests have yielded a steadily growing surplus.

In your general review of these Budget Estimates you have very properly directed the attention of Local Governments and Administrations to the necessity of checking the recent large and continuous reduction in the surplus revenue of the Forest Department. I trust that your remarks on this subject may lead to such improvements in the management of the State Forests as will ensure more satisfactory results in future years, and that it may not be found necessary, in consequence of diminished revenues, to restrict expenditure upon the requisite works of forest conservancy.

Utilization of Bamboo for Paper-Stock.

THE following papers on this subject have been received from the Secretary to the Chief Commissioner of British Burma:—

From the Conservator of Forests, Pegu Circle, to the Secretary to the Chief Commissioner, British Burma, 3rd May 1880.

I HAVE the honor to submit copy of a letter from Mr. Routledge, of 18th March 1880, together with a memorandum on the practical working of the British Burma bamboo forests for paper-stock.

The enterprise seems to me worthy of support, and, if I may be allowed, I would most respectfully make the following suggestions:—

1. As regards bamboo shoots obtained from natural forest—
 - (a) that the promoters of the enterprise should obtain such shoots, free of royalty, for a certain fixed number

of years, and afterwards half the amount which may be payable on mature bamboos:

- (b) that they should, for a certain fixed time, have the firewood for the use at the crushing factories free of charge.

2. As regards land for plantations, I would recommend that a limited area of waste-land be granted to the promoters on suitable terms, one of which should be that the land be, *primâ facie*, used for the purpose asked for, and that the promoters may not sell any material growing thereon, save bamboos, without first paying its price to Government.

3. I have the honor to request early orders how to answer Mr. Routledge's letter.

Memorandum by the Conservator of Forests, Pegu Circle, on Bamboos for Paper-Stock.

IN July last I was deputed to Claxheugh, near Sunderland, to see the manufacture of paper from bamboos sent from Burma.

I did not, and do not, intend now to describe the process by which the bamboo is converted into paper, further than that the bamboo was crushed by iron rollers, that the nodes were cut out by steam saws, that the pieces were boiled in a caustic solution, then torn by a steam-driven scutching devil, and dried by being gradually moved up through a drying tower, through which a blast of hot air was driven. After this, the woolly-looking material was treated like any other paper-making material, by being boiled in large vats, with bleaching chemicals, and constantly passed through closely-fitted rollers armed with knife edges.

The result was an exceedingly strong and even paper, marred only by numerous yellow scabby-looking spots, which, under a magnifying glass, it was easy to see were pieces of the hard silicate outermost skin of the bamboo, which had not been sufficiently affected by the boiling in the alkali solution.

It seems at the same time clear that if the bamboos are exposed, the action of the caustic solution sufficiently strong, and for a time sufficiently long to effectually soften these glassy scales, the rest of the fibre, the chemical composition of which is different, would be destroyed.

The question which thus arose is whether (1) this outer skin is of the same hard nature in quite young bamboos; (2) whether it would be possible to prevent the hardening of the skin by protection from the sun, or otherwise after the bamboos have been felled.

I made, after my arrival in Burma, a series of experiments, and find that the outer surface begins to harden when the young shoots have attained an age of two months, but remains still soft beneath the sheaths in sheathed species; soon, how-

ever, after the bamboo with a still soft surface skin has been filled, the outer cuticle hardens, even if *not exposed to the sun*, and feels glassy to the edge of a knife or touch with the teeth.

It is possible that this might be prevented by sinking the young shoot into water; but this is an operation exceedingly difficult and expensive if it has to be carried out on a large scale. The buoyancy of the material is too great, and we found the greatest difficulty in sinking a raft of only a few hundred stems.

In my opinion, it will, therefore, be necessary to crush the bamboo as soon as possible after it has been cut.

Premising this, it remains for consideration whether, and in how far, it will be practicable to utilize the bamboo resources of this country for paper-making, both with regard to natural forests and artificial plantations.

For years to come, even if the scheme of plantations turns out practicable in every way, the only resource lies in the natural bamboo forests; and the question is in how far the forests can satisfy the probable demand, and which is the best manner of extracting the material.

One factory, I understand, should, in order to be profitably worked, turn out 3,000 tons of stock annually. According to my estimate, it will take 1,000 large green bamboos to yield one ton, or 3,000,000 shoots for each factory.

A good bamboo forest can yield 150* young shoots per acre, and would, therefore, consume the outturn of 20,000 or nearly 32 square miles. Bamboo forests of this extent are available in several places in the Pegu circle; and after enquiries instituted during the forest season just elapsed, I have come to the conclusion that the best places on which crushing factories could be established in the Pegu circle are Zangtoo on the Pegu choung, about 50 miles above Pegu, Way on the Thongzai choung, 22 miles above Thongzai, and Kynai, making on the Beeling 14 miles above the railway line.

Suitable shoots are only obtainable from 15th August to end of November, and during this period the whole 3,000 tons have to be crushed. At the same time, the material can be taken down on bamboo rafts to Rangoon.

It is possible to get at present a limited quantity of young bamboo shoots at the places above mentioned, at a cost of Rs. 15 per thousand; and if the managers of the factories managed gradually to absorb the bamboo trade on the Pegu, Thongzai, and Beeling streams, which amounts to some 600,000 to 700,000 mature bamboos per annum, and which is at present exceedingly profitable, they ought to be able to obtain the whole quantity of young shoots at the above price, and obtain

* Valuation surveys in the Pegu Forests gave 300 young shoots per acre.

carrying power for the crushed material to Rangoon, where, in all probability, their central factory would be located.

The forests would be benefited by the work in question, especially as regards the reproduction of teak; and it has been observed that where bamboo-cutting has been most severe, the reproduction of teak, and general improvement of the forest, has been most successful.

The great drawback to thus solely depending on the natural forests for the supply of young shoots is the limited time during which they can be utilized, and it has often been proposed to augment this resource by the creation of irrigated plantations. It is argued that sugarcane is thus grown by irrigation in India, Egypt, Spain, Peru, and elsewhere, and that it would thus be possible to force a continuous crop of young bamboo shoots.

That it will be possible to extend the period of the growth of young shoots there is no doubt, and Burman gardeners tell me that they have obtained shoots from bamboos during the hot weather, but such shoots are nothing in size to the rain shoots. This is natural, as the evaporation through the leaves during the hot season is far too excessive. Hot-house experiments are no proof whatsoever, as the air can be kept moist, and evaporation at exactly the degree of intensity required.

I have my doubts whether it will be possible materially to change the character of the bamboo in that respect, though it is natural that the annual yield of young shoots would be materially increased. To what extent I am not in a position to predict, but the subject is worth a trial by anybody interested in the question. I have selected a few clumps of bamboos in a suitable locality near Rangoon, which are now treated with a view to ascertain in how far irrigation will increase the yield of young shoots, and whether it will be possible to obtain a constant yield throughout the year, and an acre of different bamboos will be planted during these rains in the Tharrawaddy forest garden.

The enterprise, if commercially feasible, would be of great importance to the province by opening out a new industry, and is worthy of all support which can be given to it.

Demi-official from T. Routledge, Esq., Glasheugh, Sunderland, to the Conservator of Forests, Pegu Circle, dated the 18th March 1880.

I have just received your welcome letter of the 6th February, and am disappointed to learn the delay in the plantations of bamboos, especially as I had fully counted on their success, and this loss of a year, coupled with your report as to the costs of collecting young season shoots from the natural forests, is to me a very serious matter.

I cannot say that I am very much surprised at your views thus expressed, "that the supply of labour for collecting these young shoots is very limited," as looking at the very short season during which such collection must, of necessity, for season shoots, be confined, in spite of what numerous other corresponding friends have asserted, I failed to see how the supply for a central factory for the whole year's consumption could be assured, and thus my anxiety to see whether a greater or longer continuity of cropping could not be forced by regular plantations, which system also, by confining the bamboo supply within a smaller radius, would obviously at the same time minimise the labour, cost of cutting, and collection, as well as that of the mechanical preparation of the rough raw stock and its carriage to a central factory.

I am very much obliged by your investigations and experiments as to the hardening and silicification of young bamboo shoots, as they confirm conclusions I had arrived at *theoretically*. The reasons are as follows:—

We know that young shoots contain, say, at eight to ten weeks old from 60 to 70 per cent. of sap. Now, this sap is in a fluid condition, and present throughout the whole length the shoot: this shoot being transversely sectioned by nodes, it is obvious that no evaporation of the sap as and when the shoot dries, which with your heat takes place rapidly, can possibly result *from the inside*; it therefore follows that all evaporation of sap must be through the walls of the annulus *from the inside to the outside*.

Now, the sap contains in solution silica or silicic acid, lignine, pure resin, glutinous, starchy and colouring compounds as substances; and as it follows that only the aqueous or liquid portion of the sap evaporates, it also follows that as such evaporation or drying takes place, such compounds are deposited in a solid form in the corpus of the annulus, and the silica, the most difficult chemically to deal with, forms a glassy skin on the interior wall, thus sealing up its analogues or *confreres*.

Now, if the young shoots can be crushed when green and freshly cut, such crushing expresses the major portion of this fluid sap, and, therefore, *while fluid* these extraneous matters are, to a great extent, got rid of; and thus it follows that the subsequent chemical process is very materially simplified, and the quantity of alkali required to neutralise and render soluble such extraneous compounds, very considerably diminished. I do not hesitate to say 100 per cent. or *one-half*. Now, if bamboo shoots can be floated shortly after cutting, in other words immersed in water, I think it necessarily follows that no evaporation can take place: this being, as it were, balanced, the question is, therefore, and that an important one, which I ask you to assist me to solve, how long can such immersion be continued without damaging the corpus or integrity of the bamboo? As

on this crucial point much hinges, of course such water must be kept *fresh*, that is, the pond in which such stems, waiting their turn for crushing, are stored, must have fresh water running in and out continuously. I have had young shoots *here* immersed in water for six months without apparent damage; but of course your climate and temperature is very different to this; and I am afraid that in Burma such period of immersion would be very much curtailed, and any lengthened immersion result in rotting so called,—*fermentation* and *destruction*. Still this is a very important point to clear up as far as possible.

A correspondent lately writing me, spotting as you have done the limited supply of labour during the limited period of collection for young season shoots, and also the facts that during such period of collection the jungle is naturally in a very morassy and humid condition, rendering transit for cut stems a very difficult operation, has suggested that these difficulties might be materially reduced by cutting the young shoots, but leaving them while *detached* from the stool, *attached*, or supported by the surrounding stems for a more convenient period of collection, pending which, thus, as it were, suspended, they would get dried, that is, lose two-thirds by evaporation, and then, at the drier season after the rains, be more readily collected and conveyed to a factory or station.

Of course my objection still obtains or remains, *viz.*, that such drying would leave the silica, resinous, and other compounds *deposited* in the body of the shoot; “but half a loaf is better than no bread.” I mean better to have the shoots in this condition than not at all, pending of course the formation of plantations.

Now would such shoots left *in situ* as cut get mouldy and rot? Would the weevil or borer beetle, or worse still the white ants, attack them? Can you throw any light on these points? If so, pray do.

The collection of 20,000 tons green young shoots, to furnish supply for, say, 60 tons weekly, 3,000 tons of finished stock annually, is, it must be admitted, a formidable question, and this merely for one factory.

Hence, my programme originally for the absolute necessity of plantations; and why not? Sugar is thus grown *under irrigation*, and irrigation *solely*, in Egypt, Spain, Peru, and elsewhere, the 400,000 tons jute fibre is produced from plantations annually, to say nothing of rice, hemp, flax, tea, coffee, &c., &c., and why not? Bamboo! Why not? And this more especially as bamboo plantations once formed would be, so to speak, *perennial*, whereas many of the products named above have to be sown and *cultivated annually*.

Pending plantations coming into productive cultivation or cropping, however, a factory laid down in a suitable locality, say, at or near Pegu as you suggested, we must, of necessity, avail

of supply from the native forests or jungles ; and thus I beg to confirm the contents of the last letter of the 9th March, and also that I wrote you in September.

Pray let me know therefore if *you* can forward my views as to a grant of land in a suitable locality, and the terms ; or whether I must apply, officially, to the Chief Commissioner or direct to the Viceroy, or the India Office here. On either of the two latter events kindly supply me with full details as to the locality, the extent of land, and the terms I should offer ; and I shall look most anxiously for your reply to this request, as I believe such is the rapidly increasing scarcity of rag material, and the demand for fresh material in our paper trade, that these particulars furnished I can go ahead. Without *them* I can do nothing.

You promised a letter to the Chief Commissioner. Do pray take action, as I request, and give me a *locus standi*. As you will see I am sure that to attempt to form a company or association *without* or *before* I can show I have a bamboo district, both for collection and plantations, would be like the play of Hamlet with the part of Hamlet left out?

I say no more, but relying on you remain, &c.

*From the Assistant to the Secretary to the Chief Commissioner,
British Burma, to the Conservator of Forests, Pegu Circle,
14th May 1880.*

With reference to your letter No. 139-111, dated 3rd instant, with enclosures, on the subject of Mr. Routledge's proposals to utilize the bamboo forests of British Burma for paper-stock, I am directed to request that you will be so good as to inform Mr. Routledge that the Chief Commissioner takes great interest in the success of his experiment, which he will be ready to encourage by the grant of all reasonable and proper facilities. The Chief Commissioner approves your proposals to remit the royalty on young shoots, and afterwards to charge reduced rates for a certain number of years, and to grant fuel for the factories free for a certain time. There will be no difficulty in arranging to let Mr. Routledge have a grant of suitable wasteland for the purpose of a bamboo plantation upon easy conditions.

III. REVIEWS.

The Journal of Forestry and Estates' Management.

JULY.—Among the Editorial Notes will be read with interest a notice of a paper by Professor S. Cooke, of Poona, on the climatic influence of forests. The conclusion will be hardly accepted by many. The increase of the rainfall is the object aimed at—by the restoration of forests on the hill ranges *on the large scale*. Some interesting explanations are given as to why wood-clad hills should have this effect. The writer admits that isolated groups of trees and small forests cannot do much. He undervalues, however, the effect of forest in maintaining the supply of water, in tanks, streams, and springs. Here we think he is wrong, and for a very simple reason. Even if the effect of forests on increasing rainfall is not theoretically doubtful, it is always doubtful how far any departmental exertions can practically secure it, whereas the other effect is certain, and *can* be produced. We *can* prevent water evaporating and springs drying up, and we *can* secure the flow of the water in such a way as to prevent its tearing away the soil carrying down silt and boulders, and producing ravines, and, therefore, we lay greater stress on this effect of forests. Among the Editorial Notes also some remarks on transplanting very large and old trees will also be read with pleasure.

A long paper on tile and brick-making has no interest for Indian foresters.

Next comes a paper on the "top dressing of coniferæ,"—a proceeding which may be considered in the case of parks and shrubberies, but cannot be applied to forest cultivation.

Those who have undertaken the cultivation of the *Bignonia speciosa* will find a good paper with the title of "the Western Catalpa tree." A small experiment in the Lahore district, with this tree, has been so far wonderfully successful; the rapidity of growth is astonishing.

An account is then given of the proceedings of the Edinburgh Botanical Society, which includes a notice of Captain Wood, the Oudh Conservator's experimental plots for the exact measurement of trees; no account of the method is given, and we hope some correspondent in Oudh will let us know in detail what is being done.

AUGUST.—In a former review we called attention to a paper on the question of the effect of prunings and other debris, if left to decay at the foot of the trees. This paper which,

whether we agree with it or not, is well worth reading; the Editor condemns it strongly.

The paper already noticed on "Forest Economy in Sweden" is continued.

There is little else in this number to interest the Indian Forest officer. The following notice of Sir R. Christison's communication to the Meteorological Society of Scotland, we shall, therefore, have space to reprint:—

"THE RELATION OF CLIMATE TO THE GROWTH OF TREES.—
An interesting and suggestive paper on the influence of climate upon trees was read by Sir Robert Christison, Bart., at a meeting of the Scottish Meteorological Society, in Edinburgh, on the 21st July, in which he proposed that the Society should institute an inquiry into the relation of climates in Scotland to the growth of trees. In the course of his remarks on the subject, he said that on examining a section of a tree trunk, it would be observed that there was a difference in the amount of wood in the various rings, and these variations were due to the circumstances in which the tree was placed at different periods during its growth. Doubts had arisen as to the uniformity of this rule, but he himself had never met with a single exception to it. These exceptions must be so very rare as scarcely to interfere with any practical application of the general rule. He then referred to a section of a tree which had been blown down at Barston, near Chesterfield, Derbyshire, in which there were 480 rings distinctly marked, and these rings were in some parts of the tree very irregular. If account were taken of the external measurements of trees, they should be able to appreciate the influences in question which affected their growth, and by observing certain invariable precautions it was easy to obtain uniform and trustworthy measurements to the accuracy of a tenth or twentieth part of an inch. The main advantages of the method were that they could separate the influences of each season as regarded growth, and come to a definite conclusion in a short time, whereas hitherto they required several years for that purpose. His object was to ascertain whether the Meteorological Society would not find it suitable, with their great advantages and numerous opportunities of observation at their many stations, to organize a methodical inquiry into the influences of the various climates of Scotland on tree growth. The measurements would require to be ascertained and noted with the greatest exactness, and also the elevation and exposure precisely described, and information given as exact as possible as to the cold in winter, and heat, sunshine, and rain from spring to autumn, as well as any other collateral circumstances, such as accidental injuries, and ravages of the insect tribes. As indicating the valuable results that might be obtained from the proposed inquiry, Sir Robert stated what he had himself observed last autumn in a wood at Dull, Strathtay,

where the proprietor objected to thinning his wood. In this wood, he said, his attention was principally directed to the larches, which, taking the average of the most favoured localities, had, he found, grown during their first thirty-three years at the rate of one inch in radius in seven years. Taking this growth, and comparing it with a growth shown in a section of a larch from the Glamis grounds, which measured twelve feet in girth, and which was 110 years old, he found this—that in the Glamis larch there had been a growth of an inch during three years and a half for the first thirty-two years, and that it was therefore presumable that, though the trees at Dull now looked healthy enough, they had ceased to grow at a profitable rate. He afterwards visited the wood on Drummond Hill, belonging to Lord Breadalbane, which lay on the opposite side of the valley to the one he had already described. He found that the best larch trees there were about eighty-five feet in height and four feet ten inches in girth. On proceeding to ascend the hill he observed that great care had been taken to thin out the wood. He observed very little difference in the appearance of the wood for the first 200 feet of ascent. Suddenly, at the height of 800 feet above the sea, he came upon a shelf where the soil was much deeper, and there they found trees seven feet ten inches in girth, and from 85 feet to 115 feet in height. As they went further up the trees diminished in growth. This showed that the effect of elevation, heat, exposure, and soil were all circumstances to be taken into account in explaining the variations in tree growth.

"The Chairman, Professor Geikie, in concluding the discussion, said that he had no doubt the Council would be very glad to give Sir Robert Christison's suggestion the most careful consideration. There were two phases of interest in connection with this question—a prospective interest and a retrospective interest—inasmuch as while valuable for the guidance of arboriculturists in future, the inquiry might also yield much information as to the meteorological conditions of past years. Last year, when in the great forests beyond the Rocky Mountains, he was struck by the uniformity of growth which he found in the trees; and evidently it was the case that for a long period before their final decay the trees which he had seen lying on the ground in thousands had not grown at all. They had exhausted the soil round them, and being simply encumbrances of the ground, it had only needed some extra storm to uproot them. The proposal to remit the matter to the Council was then agreed to."

SEPTEMBER.—There is but little in this number either. "Steam Cultivation," we fear, cannot yet attract us. A paper on the Wirrabara forest of South Australia is, however, interesting, and pleasantly written. There is also an article about "Training Indian Foresters." For some time past we have abstained

from taking any notice of the attacks made by the Editor of this journal on Indian Forestry. We have felt that he was effectually defeating his own cause, by his misstatements and his often ungenerous reflections on a hardworking class of officers, who are fortunately too well educated to care for the barking of such literary snarlers. The special article, however, in this number is not from the Editor, but from a gentleman who writes F.R.S. after his name, and calls himself HIST. NAT. PROF. We, therefore, feel bound to notice it, and then once for all to take leave of the subject.

The learned professor informs us (after the usual introduction regarding the vastness of the empire, &c.) that the Indian "forests consist of trees belonging to families totally distinct from those familiar to the European arboriculturist." We had always thought that the cedars, the pines, the oaks, the maples, and not a few other trees which make up the bulk of our Northern Forests, are not altogether unknown in Europe, but on the authority of an F.R.S., we must conclude that we are mistaken in supposing that any *Coniferae*, *Cupuliferae* and *Betulaceae* exist in Europe, or that *Pinus*, *Cedrus*, *Acer*, *Quercus*, *Carpinus*, &c., &c., are known in France or Germany.

It is true indeed that the *Tectonas*, *Shoreas*, *Terminalias*, *Dalbergias*, *Acacias*, *Pterocarpi*, *Dipterocarpi*, and many other species of Central and Southern India and Burma, are different from the European families. But the large order of *Leguminosae* is certainly not so unknown in Europe as to make the Indian species a stumbling block to the forester trained in Europe. Nor indeed is it true that any such wide difference exists between an Indian forest of any kind, taking it as a whole—its soil, atmosphere, upper and under growth together—that the *principles* of management, learned in Europe, are found to be reversed in Indian practice. The principles of forest science, as MR. SYM SCOTT said, are the same all over the world. It is a singular thing, which MR. BOULGER and his friends might do well to lay to heart, if indeed they ever troubled themselves with such trifles as *facts*—in concocting their attacks on Indian Forest administration, that the two solitary instances in which the English or Scotch "practical" forester (of the class MR. BOULGER would approve) has been successful, are to be found in the forests of the Central Provinces and in the steamy tropical teak plantation of Nilambúr. These forests, MR. BOULGER assures us, have nothing in common with Europe, so that if the knowledge of *principles* which the French schools so much insist on, is thrown away, *à fortiori* one would suppose, the confessedly empirical *practice* of a Scotch or English estate would be so also.

But the professor's geography is no better than his botany: in another part of his paper he tells us that Saharanpúr is a station in the hills! We did not know that the S. P. D.

Railway Company, on whose line the station in question is conspicuously marked, had succeeded in running their line up the cool slopes of the Himalayas. Or perhaps Saharanpūr is in the Nilgiris? If an F.R.S. does not know, who else does?

But geography and botany apart, MR. BOULGER makes some other remarkable statements.

He says, for example, that the India Office makes over the selection of candidates to the Civil Service commission "as respectable and conservative a red tape office, &c., &c." Surely MR. BOULGER must know that this is not true. A committee under special instructions sits to select candidates; health, activity and gentlemanly character and demeanour—all of equally great importance in India—being specially looked to before the competition begins. He also speaks of the extremely cheap living at Nancy and the by-no-means heavy fees, as constituting an "expensive training." Still more strange: MR. BOULGER is so ignorant of the requirements of the department he is writing about, that he actually goes out of his way to *admit*, the very facts against which he ought to contest. He admits, for example, that the French student has time to become acquainted with "the French method of Sylviculture." Now the "French method of Sylviculture" is simply the method of aiding and following out the processes of nature, and is based on a general study of all the fundamental elementary sciences that directly bear on forest management. This,—coupled with good general ideas on the subject of the control and management of forest estates is just what we want. Such a plan is unknown in England, where, owing to the absence of natural forest on the large scale, forestry is much more devoted to dealing with *trees as individuals*.

We ask for nothing better than to have for the supervision of Indian forest divisions—(1) *gentlemen*, socially and by education, and in every other respect, *gentlemen*; (2) who have received a good general education so as to cultivate their powers of observation, and enable them readily to apply their knowledge of *principles*, to the facts of Indian forest work; and (3) a general but thorough knowledge of the principles of *Sylviculture* (not merely *arboriculture*), *i.e.*, the survey and demarcation of forest estates, the principles of forest law and settlement of servitudes, the taxation of forests, the treatment of ill-used forests in different stages, and a knowledge of the physical conditions under which forests grow, and which it is necessary to maintain or to produce in order to secure success, as well as the effects of forest on the soil and climate (under which I intend to include the study of the principles and practice of "Reboisement" forestry).

We maintain that this sort of men, Nancy and the present system produce for us, and that anybody who knows anything about forest administration knows that on the whole (for no

system, however perfect, can prevent *individual* failures) the system has succeeded beyond expectation.

The simple and not very creditable facts of the foolish controversy into which the English journal has rushed are these:—A certain set of people are bent on securing a lot of Indian appointments for a particular class of men most useful, honorable and deserving in their own sphere, but totally unfitted (as in nearly every case our experience has shown)* for the control of Indian Forest Divisions.

The Indian Division is not a small estate in which a practical neat-handedness in pruning trees, planting out rows of larch and Scots fir and oak, or an empirical skill in thinning a coppice of a few acres, or an arboretum on a great estate, is of any avail.

The first thing is the efficient control of the native subordinates, and to get a hold over all the neighbours whose incursions may affect the forest.

Now for this a *gentleman* is a *sine quâ non*. It is silly to affect to ignore the patent facts of social life. Society classifies itself by a natural law, as surely as the deposits of a river do, into regular layers. An able man out of any class may always exceptionally fill with credit a place in the upper layer, and in the upper rank unfortunately may be found individuals who would be a disgrace to the lower. But still as a fact there is a class which everybody understands when the term "gentleman" is used. Of that class,—the very sons of clergymen, officers, and merchants that Mr. Boulger complains the India Office selection gives us—our divisional officers *must* consist. The class of "head gardener," "bailiff," "foresters' son," and so forth, honorable, steady and intelligent as its members often are, will not do. They do not find a sufficient body of their own class to associate with, and it is a notorious fact that they always fail to control properly the native—except perhaps in keeping a set gang to a specific

* It is well known that several "practical" English and Scotch 'foresters' have been sent out. They had no education, but had learnt empirically to do certain operations with, no doubt, admirable neatness and efficiency: but as to managing large areas of Indian jungle, they had no idea: they found few associates of their own class, could never get on with the natives, and generally ended in being shipped back to Europe, or dying of drink. It was not the men's fault so much as the utter want of "adaptation to their environment." There are of course exceptions to every rule, and two officers out of the whole lot have succeeded—one, a gentleman evidently of very superior ability to begin with, has turned out an able forest officer just as many others have, who previously never saw a tree planted in their lives, but who by long practice have acquired knowledge; for the other a poet was found in a regular artificial plantation, where the experience of an English estate plantation is invaluable. This of course is quite the exception in India. We have always room in special cases for special appointments; but that is not the question. The point at issue is the general principle of supply, for the ordinary departmental charge of Indian Forest Divisions. In the same way it is obvious that, if any of the class which the journal advocates, possess the necessary fitness of education, manner and so forth, it is not at all difficult for the young generation to go into competition and pass through Nancy. The Committee do not ask whether a young man is descended from the Conqueror, but whether he, personally, is a gentleman, who can associate on equal terms with the District Officers and others with whom he will be thrown in contact.

work; they do not possess, as a rule, sufficient general education to make them assimilate the facts of Indian Forestry, or adapt their own lives to their surroundings. Unless they can be posted to some artificial plantation, their knowledge is absolutely useless in a natural forest or a great "jungle."

Yet it is this class that the English journal is bent on forcing on the authorities. And in order to be able to maintain its point, it is compelled to ignore the opinions of experienced conservators in India, to deny the plainest facts, and to throw about reckless and ungenerous abuse of men whose history it does not know, and whose successes it refuses to hear of.

The English journal neither knows nor cares anything about the welfare of India, or the real success of its Forest administration. If it did, it would be willing to hear the facts; it would come into correspondence with the ablest of our forest officers, whose work, as it is, it ignores, and whose journal, (while giving monthly notices of the obscurest continental *feuilletons*) it ostentatiously ignores.

We do not know anything more disgraceful in journalism than this continued attempt to secure the bulk of Indian appointments (poorly paid as most of them are) to a class which is totally unfit to occupy them; and to secure it, by unfounded statements regarding the French training, and by ignoring the plainest experiences of actual Indian administration. With these remarks we take leave for ever of this distasteful subject.

Forest Reports of Assam, Bengal and British Burma for 1879-80.

THE review on the Assam Forest Report for 1879-80 is published in the *Assam Gazette* for September 18th. It appears that as in Bengal and elsewhere the year was favorable for fire protection, and few fires occurred. On the subject of Jhúm cultivation the Chief Commissioner's remarks are worth noting.

"Jhúming has been kept well in check during the year. In the Námbar forest, in Sibságar, it was completely excluded, and in Cachar, where, owing to the habits of the people, it is difficult to keep under sufficient control, great success was attained. The Chief Commissioner has recently called the Deputy Commissioner's attention to the question in this district, and has asked for a report on the sufficiency of the areas allowed to the jhúming tribes in the neighbourhood of the reserves. The question is one of some difficulty, both because these tribes are unacquainted with, or at any rate will not

take to, any other form of tillage, and because it is upon them that forest operations in Cachar mainly rely for labour; if they are forced to remove from the neighbourhood of the forests, the supply of labour may seriously suffer. At the same time, the Chief Commissioner fully recognizes the absolute necessity of bringing this destructive form of cultivation under control, even at the cost of some temporary inconvenience to the jhúming classes. Gentle pressure to induce them to betake themselves to the grass lands and unprotected forests, where they can jhúm without injury to the interests of Government, can be no hardship to races who have no local attachments to detain them, and are quite accustomed to roam wherever they find the ground suitable for their operations. In Cachar, moreover, which is at present the one district where the operations of the Forest Department proper are remunerative, and on which the teeming population of the Súrma Valley and the adjacent districts of Bengal mainly depend for their supply of timber and forest produce, proper conservancy is of the highest importance."

The disposal by the Khedda Department of the elephant-hunting in the Langai-Singla forests of Sylhet is the subject of some remarks by the Chief Commissioner as follows:—

"In the first of these no progress has been made in forest management during the year, owing to the continued reservation of the Singla and Langai tract for Khedda operations. These were the first time for several years carried out (though the forest has all along been closed to wood-cutters), but not by the Khedda Department. The Chief Commissioner, has only lately learnt that that department, being unable to work the tract itself, let the elephant-hunting therein to a native for Rs. 1,050, which was credited to the department. As he has not yet been informed of the circumstances under which this was done, Sir Steuart Bayley abstains from discussing its expediency. He would, however, observe that, as the department did not require the forest for its own operations, it should have been placed at the disposal of the civil authorities, as was done this year (1880-81), and that he does not perceive how the receipts from a private lease are legitimate assets of the Khedda Department."

The financial results of the year in Assam were as follows:—

Receipts	...	...	Rs. 1,64,335
Charges	...	...	„ 1,82,829

Rs. 31,506

much about the same as the previous year.

Sir Steuart Bayley's review concludes into a remark regarding the relation between District and Forest Officers which is not without interest.

"The two most important points in Mr. Brandis's "Suggestions" dealt with the relations between the district officials and the forest officers employed in their districts, and with the question of raising a revenue from caoutchouc. The Report was circulated to all District Officers for opinion on these proposals, and their replies were for the most part not received till after the close of the year; one, that from Kámrúp, has not even yet come in. The Chief Commissioner, in the press of other work, has not yet been able to give sufficient time to the consideration of these questions, one of which, that of caoutchouc, presents great difficulty; he hopes, however, soon to be in a position to submit his conclusions to the Governor-General in Council. Meantime, he would remind the Government of India that, as regards the position of the forest officer with reference to the district authorities, the present state of things is not widely different from that existing in the Central Provinces. In the management of the district and protected forests the Deputy Commissioner is already instructed to consult his Forest Officer, when there is one, and to have the wood on land applied for for cultivation valued by professional agency. Something may doubtless be done to systematize further the relations between the two, but in regard to the reserved areas Sir Steuart Bayley, as at present advised, is inclined to think that it will be best to retain the present direct subordination of the forest staff to the head of the department."

The review on the Bengal Forest Report for 1879-80 has also been published. Fire protection proved as successful, owing to the favourable weather in Bengal as in other provinces. On the subject of planting in the Sikkim Hills, the Conservator's remarks are quoted, which we reproduce:—

"Planting in the Darjeeling Hills is by no means difficult below an altitude of 7,000 feet, where the difficulty exists is in the time required for raising plants in the nurseries, until they are large enough to be put out without fear of their being choked by the ground vegetation which is usually so profuse. Besides, seed is not procurable every year; the oaks scarcely give one crop every three years, and some of the best species, like *Quercus pachyphylla*, are most difficult to procure sound. The magnolia seed usually takes a long time to germinate. Perhaps the easiest hard-wooded tree to grow in the hills is the pipili (*Bucklandia populifolia*), which, of late years, has been very successfully grown; maple and toon are always easy; while of exotic trees the ash (*Fraxinus floribunda*), and cypress (*Cupressus torulosa*), seeds of which have been procured regularly from the North-West Provinces, have proved themselves to be perfectly hardy, and to be as easy to raise as most trees indigenous to Sikkim."

The financial results of the year were—

Receipts	...	...	...	Rs. 4,49,524
Expenditure	...	...	...	„ 2,75,748
Surplus				Rs. 1,73,776

The lately published review by the Chief Commissioner on the Forest Reports of British Burma for 1879-80, found in the *Burma Gazette* for September 11th, 1880, gives some considerable information regarding the year's work. Naturally, demarcation work is the most important, and on the subject the Chief Commissioner says; with the view of pushing it on faster :—

“A state of things, such as is described at paragraph 210 of the present report, makes it most desirable that the demarcation of the reserved forests should be judiciously and expeditiously pushed on. Very much in the way of demarcating State reserves still remains to be done. In the Sittang Division, the conservator estimates that the work will occupy fifteen working seasons, during ten of which the services of a civil officer will be required. In Prome five seasons will be occupied, involving the presence of a civil officer for a total period of sixteen months, one season will suffice for demarcation work in Tharrawaddy, five will be needed for Rangoon, five for Shway-gyin, and, as far as can yet be roughly estimated, four for the Western Division. If two demarcation parties are at work steadily throughout each season, and receive help from the district officers, the conservator thinks that the demarcation of all reserves in his circle can be completed in twelve years. On the Tenasserim side, Major Seaton estimates that ‘there are 525 square miles of teak and other valuable forest which may have to be demarcated;’ and that if two civil officers are allowed, four seasons will suffice to finish it thoroughly. The work is far behind in Pegu, and its rapid completion is a matter of such importance that special arrangements will be attempted in order to accomplish the business in a shorter time than Mr. Ribbentrop calculates.”

Fire protection works in Burma were successful, owing to a good season, in the same way as they were in Bengal and Assam, though it is reported that there was a bad fire at Magayee.

With the orders for the discontinuance of the Kyet-pyoo-gan plantation we are disposed to agree. The Chief Commissioner says as follows :—

“To afford greater protection to the Kyet-pyoo-gan plantation, proposals which had been for some time under consideration, ended in the acquisition, soon after the year closed, of a strip of land to the south of the plantation, about 600 feet in breadth. Beyond this, the plantation was not extended in any way; but it has been divided into separate blocks, which arrangement will make protection from fire easier than before. The early rains

prevented any extension of area in the Magayee plantation. A valuable work has, however, been accomplished in the laying down, round its border, of a broad line of evergreen trees ; and since the close of the year, a space of 108 acres, which had been cleared, has been burnt over, and teak seed is being laid down. A sketch-plan for the working of this plantation during the next five years was laid before the Local Government in September 1879, and the papers were shown to the Inspector-General of Forests when recently in Burma. Mr. Brandis is of opinion that the plantation should not be extended, since it has been shown that teak can be reproduced more cheaply in *Toungya* plantations, and by other methods, than by means of special plantations on a large scale. In this opinion the Chief Commissioner fully concurs ; at the same time, the existing plantation will be maintained. The total cost of these two plantations during the year was Rs. 11,716."

There is no doubt but that much heavy expenditure in Burma and elsewhere has been incurred in making elaborate plantations when a system of reproduction, either partly natural or wholly artificial, is practicable without the heavy establishments and extra expenses of a distinct detailed plantation scheme.

The financial results of the year were as follows :—

Receipts	...	...	...	Rs. 11,80,189
Expenditure...	...	...	...	,, 7,53,489
				<hr/>
Surplus	...	...	,,	4,26,700

With this, however, the Chief Commissioner is evidently not contented, for he says :—

"The conservators and their officers must always keep in view the obligation that lies upon us to restore to their former level the public revenues from these magnificent State properties, the forests of Burma."

We are glad to see that the teak trade was much reviving at the end of the year, and principally in consequence of activity in the ship-building yards at home.

The total number of logs of foreign teak imported was 144,344, while 22,254 logs, besides other pieces, and 2,736 logs of kinds other than teak, were brought out of the Government Forests during the year.

We are rejoiced to see that forest conservancy work is to be started at once in Arakan. The review says :—

"Preliminary steps have been taken towards placing the forests of Arakan under the direct control of Government. The Conservator of the Tenasserim circle was deputed to make preliminary enquiries, to ascertain what species of tree should be declared reserved, and at what points timber revenue stations should be established, in consultation with the Commissioner of the division. The subject was also discussed with the Inspector-

General of Forests; and recently an Assistant Conservator of Forests has been appointed to the Arakan division. It is very desirable, in the interests of forest administration in Arakan, that the proposed Forest Act for Burma should come into force soon."

We suppose the work at first will be confined to the establishment of revenue stations, and the collection of tolls as in Chittagong, to be immediately followed, as there too, by the demarcation of permanent reserves.

Annual Reports of the Superintendent, Royal Botanic Gardens, Calcutta; Superintendent, Cinchona Plantations; and Government Quinologist for 1879-80.

THE Report on the Botanic Gardens records the progress that has been made in laying out the grounds,—progress that is very obvious to any one who has lately visited them, and can compare them with the condition they were in when the present superintendent took charge.

It seems that some of the coarse grasses of Orissa, which have lately been tried in England, have been comparatively favourably reported on. The Lieutenant-Governor's review says:—

"It seems that the two varieties, known as *Ranikharja* and *Tiansi*, are little inferior to *Esparto* grass, which is so largely exported from Spain for this purpose. The *Sara* grass also appears to be of good quality. Dr. King's correspondent states, regarding *Ranikharja* and *Tiansi*, that 'if they can be had in large quantities, and at the price of *Esparto*, they might be worth trying on a large scale.' Larger quantities will be sent to England for further trial at the close of the present rainy season, and the Lieutenant-Governor requests that the result may be specially reported as soon as it is known."

Further confirmation is given by Dr. King of the utter unsuitability of the Carob tree to the climate of Lower Bengal, and the waste of time and expense in attempting to grow the species of *Eucalyptus*. On the other hand the following extracts record the success of the rain-tree (*Pithecolobium Saman*):—

"The demand for seed and seedlings of the guango or rain-tree (*Pithecolobium Saman*) continues very great. As yet seed is yielded to a very small extent by the few trees of this species that exist near Calcutta, and I have been obliged to indent on the Government of Jamaica for supplies. This wonderful tree grows faster than any hitherto introduced into Bengal, with the single exception of the *Casuarina*. It gives a beautiful shade, and yields a pod with a sweet pulp which is greedily eaten by cattle. For avenues, cantonment, squares, and situations where dense shade is wanted, no tree is more suitable than this."

The results of the attempts to introduce exotic India-rubber-yielding trees are described in the following extract from Dr. King's Report:—

"Of the three India-rubber-yielding species, of which seeds were collected in South America, at the instance of the Secretary of State for India, living plants of only two, viz., the Para and Ceará rubbers, were ever received in this garden. The Para rubber (*Hevea Brasiliensis*) has proved quite unsuited to this part of India, and is not likely to be accommodated with a suitable home in any place so far from the equator as Calcutta. The Ceará rubber tree (*Manihot Glaziovii*) has, on the other hand, proved very hardy in Calcutta. Our first-received plants looked, for some time after their arrival, weak and lanky, and I was for some time not very hopeful about them. Further experience showed that these appearances had been the result of coddling, and that, when freely exposed to sun and rain, this *Manihot* is a wonderfully hardy plant, capable of standing the roughest treatment, easily grown, and readily propagated. If its rubbery urns out really good, the cultivation of this species will, no doubt, be taken up by tea-planters whose gardens are on the plains, and by indigo planters as adjuncts to their other cultivation. In expectation of large demands for young plants and seeds, I have made a Ceará plantation on a suitable piece of ground on the outskirts of the garden."

This is the first report which mentions the new branch garden at Darjeeling known as the Lloyd Botanical Garden. The new garden was started and set in working order with great expedition, and will probably prove one of the most valuable and useful of the smaller Botanic Gardens of India.

The Cinchona Plantation and Quinologist's Reports are very interesting, and show the great value of the plantations to Government, both directly in the supply of cheap febrifuge and in direct profits. The Lieutenant-Governor's review gives the following account of the financial position of the plantations for 1879-80:—

"The result of the operations of the past year, from a financial point of view, has been most satisfactory. The revenue derived from the sale of the febrifuge, and a small quantity of bark, seed, and plants to the medical depôts and to the public, amounted to Rs. 1,36,773, as shown below:—

		Rs.	As.	P.
Febrifuge sold to the public	...	46,808	8	0
Seed, plant, and bark sold to the public	...	789	8	0
Credit Medical Depôt, Calcutta	...	57,850	0	0
Ditto ditto, Bombay	...	26,425	0	0
Ditto ditto, Madras	...	4,955	0	0
Total	...	1,36,773	0	0

"This sum, according to the figures given in the Quinologist's report, was Rs. 56,260, in excess of the expenditure on account of both the plantations and the factory.

"The total expenditure on the plantation from its commencement (including compound interest at 4 per cent.) is a little less than ten lakhs of rupees. The cash transactions for the year, therefore, show a profit of rather more than $5\frac{1}{2}$ per cent. on the capital. But this does not represent the whole of the gain for the year, for the stock in hand has been increased in value by Rs. 42,775, which is equal to another 4 per cent. on the capital. The amount of febrifuge used in substitution of quinine in Government hospitals and dispensaries during the past year was 5,400lb. Calculating the average price of quinine in Calcutta at Rs. 90 (a rather low estimate), the saving effected by this substitution during the year has been very nearly four lakhs of rupees, and the total saving since the factory commenced working aggregates $11\frac{1}{2}$ lakhs of rupees, or more than the plantations have cost since their opening."

The plantation was very largely extended in the Sittong Block, and a much larger proportion than usual of *Calisaya* plants were put out.

The year 1879-80 was also notable for the introduction of a new species of great value, viz., the Carthagena or Columbian bark. The plants are doing well, and there is every hope of their being successfully propagated.

Dr. King, when reporting that some yellow bark had been sent to London for sale, remarks that recent experiments have shown that it may be possible to make sulphate of quinine out of yellow bark on the plantation. This we understood, at a recent visit we paid to Mangpu, that their hope has since been amply realised, and that the Manager, Mr. Gammie, has been successful in his endeavours to find a cheap and easy method of manufacturing the sulphate of quinine.

IV. NOTES, QUERIES AND EXTRACTS.

SOUTH AFRICAN TIMBER.—The following is extracted from "The Colonies and India." The useful kinds of timber indigenous to South Africa number some hundred varieties, only a few of which, however, have hitherto been used for manufacturing purposes, and those only to a limited extent: and yet, although the forests cover an area of many thousand square miles, there are not wanting indications in certain districts of a falling-off in the supply. The colonial authorities are fortunately taking steps to encourage tree-planting, and forest conservation generally, and, at the same time, we are glad to see that they are not losing sight of the equally important question of at once utilizing the natural wealth of the country. Hitherto the colony has imported not only her rails, but the sleepers also, instead of utilizing some of the durable timber awaiting consumption within her borders. The principal South African forests are within a short distance of the shore; and as the denser part of the population is located round the coasts, and the railways are consequently confined to within a comparatively short distance from the seaboard, it would have seemed the natural course for the colonists to have utilized their native supplies of timber in their construction. The people, however, did not actually know the extent of their own possessions in this respect, and custom had probably a good deal to do with the maintenance of the system, of "bringing coals to Newcastle," which has gone on so long. Now that the railways have thoroughly tapped the forest country, the utilization of native timber will become more general, and more stringent laws for the preservation of the forests from further drain will be necessary. The cutting of timber and brushwood in the Crown forests is placed under strict surveillance, and licenses are required to be taken out by all persons cutting timber therein. The measures adopted for their preservation, however, are a heavy item in the expenditure of the Government; and the forests, instead of being a source of revenue, are actually a dead loss, costing £2,500 in Cape Colony alone every year, and yielding only £2,000. Many of the preserves, however, will bear largely thinning out; and with proper management, and new openings for the use of their produce, they ought rapidly to become a profitable property.—*Timber Trades Journal*.

THE MANUFACTURE OF RESIN AND TURPENTINE.—From Wilmington, N.C., southward, and nearly all the way to Florida, the pitch pine trees, with their blazed sides, attract the attention of the traveller. The lands for long stretches are almost worthless, and the only industry, beyond small patches for corn or cotton, is the "boxing" of the pitch pine trees for the gum, as it is called, and the manufacture of turpentine and resin. There are several kinds of pine trees, including the white, spruce, yellow, Roumany, and pitch pine. The latter is the only valuable one for boxing, and differs a little from the yellow pine, with which it is sometimes confounded at the north. The owners of these pine lands generally lease the "privilege" for the business, and receive about 125 dols. for a "crop," which consists of 10,000 "boxes." The boxes are cavities cut into the tree near the ground in such a way as to hold about a quart, and from one to four boxes are cut in each tree, the number depending upon its size. One man can attend to and gather the crop of 10,000 boxes during the season, which lasts from March to September. About three quarts of pitch or gum is the average production of each box, but to secure this amount the bark of the tree above the box must be hacked away a little every fortnight. Doing this so often, and for successive seasons, removes the bark as high as can be easily reached, while the quality of the gum constantly decreases, in that it yields less spirit, as the turpentine is called, and then the trees are abandoned. The gum is scraped out of the boxes with a sort of wooden spoon, and at the close of the season, after the pitch on the exposed surface of the tree has become hard, it is removed by scraping, and is only good for resin, producing no spirit. The gum sells for 150 dols. a barrel to the distillers. From 16 barrels of the crude gum, which is about the average capacity of the stills, 80 gallons of turpentine and 10 barrels of resin are made. The resin sells for from 1.40 dols. to 5 dols. per barrel, according to quality, and just about pays for cost of gum and distilling, leaving the spirit, which sells for 40 cents a gallon, as the profit of the business. Immense quantities of resin await shipment at the stations along the line, and the pleasant odour enters the car windows as we are whirled along. After the trees are unfit for further boxing, and are not suitable for lumber, they are sometimes used to manufacture tar, but the business is not very profitable, and is only done by large companies, who can thus use their surplus labour. The trees are cut up into wood, which is piled in a hole in the ground, and covered with earth, and then burned the same as charcoal is burned elsewhere. The heat sweats out the gum, which, uniting with the smoke, runs off through a spout provided for the purpose. A cord of wood will make two barrels of tar, which sells for 1.50 dols. per barrel, and costs $37\frac{1}{4}$ cents to make. The charcoal is then sold for cooking purposes.—*North-Western Lumberman.*

A SCHOOL OF FORESTRY FOR THE UNITED STATES.—A Bill for the establishment and maintenance of a school of forestry at St. Paul, Minn., has been introduced in the Senate by Senator McMillan. It would seem to be time that some attention was paid in this country to the conservation of our forests, and this proposed school seems to be a step in that direction. As a means of supporting the proposed school, the Government is called upon to grant 300 sections of the public lands of the State, to be selected by an agent appointed by the Governor, with the approval of the Secretary of the interior. Not more than two sections are to be taken from any one township, and the selected are not to be mineral lands. The sections are then to be sold, and the proceeds invested in United States or other safe stocks, at not less than 4 per cent. interest. The capital is never to be diminished, and the interest is to be appropriated for the endowment and support of the school, which shall give instruction in the science and practice of forestry, as adapted to the climate and soil of the State. Ten per cent. of the interest may be set apart for the purchase of lands for experimental out-stations for tree culture on prairie lands, and forest culture on lands, when such experiments shall be authorized by the Legislature. No part of the fund or interest to be used in buying, erecting, or repairing the school building, and unless the school is provided with a suitable building, and 40 acres of land for experimental timber culture, within eight years, the grant is to cease. The State must employ, at the head of the school, a person of known qualifications in the science and practice of forestry, and the tuition is to be free. Pupils are to be admitted from any State. An annual report of the progress of the school, and the results of its experiments, is to be filed with the Librarian of Congress and the Commissioner of the general land office.—*Lumberman's Gazette*, quoted in *Timber Trades Journal*.

In an article in the Transactions of the Royal Botanical Society of Edinburgh, for 1879, on the exact measurement of trees, by Sir R. Christison, the tendency of the deodar to have its top shoot bending over is talked of as an "unhappy failing," and regrets expressed that it will not shoot upwards freely as it ought to do. Sir R. Christison has, we suppose, ere this been told that, so far from an unhappy failing, the bending over of the top of the deodar is as much a characteristic as the strong erect top shoot is of the spruce or scotch fir. If he had referred to Brandis's Forest Flora, he would have seen that soft and drooping terminal shoots were one of the characteristics of the tree.

THE following remarks, on the assistance given by forest officers to the Museum at Lahore, occur in the review of the

Curator's Report for 1879-80, by the Lieutenant-Governor of the Punjab, in the *Punjab Gazette* for July 15th:—

The most notable improvement of the year is the re-arrangement or rather the renewal of the section showing the woods of the country generally and of this province, which has been done by Mr. B. H. Baden-Powell. The woods of the country are now arranged in billets of uniform size, according to the classification by natural orders, and on the other side those of the province so set forth as to show the products of the upper hills, the lower hills, and adjacent country and the plains. Woods in ordinary use, those of rarer kinds, and those used as fuel, are also discriminated. Mr. Baden-Powell has also contributed pictures of the ravages of sand streams consequent on the denudation of the upper hills, the "chos" of the Hoshiarpur district, and other sketches. Under his care and with the co-operation of Dr. W. Schlich and other officers of the Forest Department, this section will become a really valuable exposition of this important subject.

THE following notice is copied from the Paper Maker's Monthly Journal of 15th June 1880:—"The Florida *Mirror* says that palmetto paper manufacturing is a perfect success, and that it is the intention of the Company, which has been experimenting, to establish about twenty mills in Florida, at places where the material will be near at hand, and transportation easy." This encourages the hope that the leafstalks and leaves of the palmetto of the Trans-Indus territory (*Chamaerops Rutchiana*) which covers a vast extent of country, may eventually find a market for the manufacture of paper.

CYPRUS.—From the report of Her Majesty's High Commissioner, Major-General Biddulph, we extract the following observations:—The planting and preservation of trees have engaged the attention and care of this Government. Great pains have been taken to plant the eucalyptus, and considerable expense incurred for the purpose both by fencing it to preserve it from cattle, and owing to the necessity of its being constantly watered for the first two years. A large plantation at Famagusta has been entirely destroyed during the last few days by the excessive cold, which, for intensity and duration, has been unequalled at that place during the last forty years. With a view to encourage the importation of timber, and to save, as much as possible, the remaining forests, the import duties on all timber, whether manufactured or otherwise, and on all fuel of every description, has been entirely removed.—*Timber Trades Journal*.

V. THE TIMBER MARKET.

Calcutta.

THE following information has been received from Messrs. Mackenzie, Lyall & Co. :—

Teak.—Prices at present are ruling low in consequence of the dulness of our market, and ordinary first-class squares can now be obtained at Rs. 70 per ton.

English squares @ Rs. 100 per ton,

Second class " " 50 per ton,

Saul logs " " 65 per log,

for sizes averaging about 37 cubic feet.

Sissoo Wood.—Ten to 15 feet and about 10 in. in diameter is scarce, and is realizing about Rs. 10 to 12 each.

Toon, Blackwood, Satin and Ebony.—The demand for these descriptions is limited, as there is hardly any enquiry. *Teak* is the principal wood used, and it appears to have superseded all other kinds. We think good *toon* can be sold at Rs 50 to 60 per ton.

Liverpool.

MESSRS. EDWARD CHALONER & Co., of Liverpool, in their circular, dated Liverpool, August 31st, state as follows :—

MAHOGANY.—St. Domingo—the present stock is 1,322 pieces, of which 1,137 are curls, and 185 are logs. Veneer and well-grown figury logs from city St. Domingo and from Porto Plata would realize full prices. Short curls are very dull of sale, at low prices. **Cuba**.—This market has been freely supplied of late, but chiefly with small wood, for which low figures have been accepted. **Honduras**.—The stock consists of one cargo—arrived yesterday—and it will no doubt meet with prompt sale, as there is a good demand for panel and machine-making wood. **Mexican**.—The market has been quiet for Minatitlan, but Tabasco has been in good demand; of the latter the stock is exhausted.

CEDAR from Honduras and Mexico is in steady demand. Pencil is scarce, and wanted.

SATINWOOD.—The stock is light, and fresh arrivals of sound wood realize high prices, there being a good demand.

WALNUT.—Italian is slow of sale. **Circassian**.—The stock of burrs is exceedingly heavy, and there has been no inquiry of late. Of logs the demand has not been active, and prices have ruled low. **American black** meets with ready sale at full value.

LIGNUM-VITÆ.—A shipment from Porto Plata has been sold at £9 per ton. The stock of all kinds is exhausted, the demand is active, and supplies of fresh, well-grown wood command high prices.

COCUSWOOD.—The demand has been only moderate of late.—*Timber Trades Journal*.

VJ. EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA—

No. 401F.—*Simla, the 30th June 1880.*—*Mr. R. N. Anstruther*, an Assistant Conservator of Forests of the 3rd Grade, serving in Bengal, is permitted to resign his appointment, with effect from the 12th June 1880.

No. 463F.—*Simla, the 31st July 1880.*—*Mr. L. A. W. Rind*, Assistant Conservator of Forests of the 1st Grade, is granted subsidiary leave for thirty days, with effect from the 18th June, and furlough to Europe for one year, under section 8, Supplement F, of the Civil Leave Code, with effect from the 18th July 1880.

No. 470F.—*The 4th August 1880.*—*Mr. L. A. W. Rind*, Assistant Conservator of Forests of the 1st Grade, formerly attached to the North-Western Provinces and Oudh, will, on return from the leave granted him in Notification No. 463F., dated the 31st ultimo, be posted to the Central Provinces.

No. 487F.—*Simla, the 12th August 1880.*—*Mr. W. H. Reynolds*, Assistant Conservator of Forests of the 1st Grade, and Deputy Superintendent of Forest Surveys, is confirmed in the 3rd Grade of Deputy Conservators, in which he is at present officiating, with effect from the 5th July 1880.

No. 520F.—*Simla, the 27th August 1880.*—*Mr. R. H. C. Whittall*, Officiating Deputy Conservator of Forests of the 2nd Grade, is transferred from British Burma to the Central Provinces, and will revert to his substantive appointment of Deputy Conservator of the 3rd Grade, with effect from the 31st ultimo, the date on which he reported his departure from Rangoon.

No. 573F.—*Simla, the 14th September 1880.*—The following officers, who are officiating as Assistant Conservators of Forests of the 3rd Grade, are confirmed in that grade, with effect from the dates specified opposite their names:—

Mr. E. F. Litchfield, Sub-Assistant Conservator of Forests, attached to the Forest Survey Branch,—1st June 1880.

Mr. W. M. Green, Sub-Assistant Conservator of Foersts in Bengal,—12th June 1880.

Mr. A. M. Reuther, Sub-Assistant Conservator of Forests in the Punjab,—29th July 1880.

No. 584F.—*Simla, the 17th September 1880.*—*Mr. A. T. Drysdale*, Deputy Conservator of Forests in the Hyderabad Assigned Districts, and *Mr. G. Mann*, Deputy Conservator of Forests in Assam, are appointed Conservators of Forests of the 4th Grade, with effect from the 1st April 1880.

No. 610F.—*Simla, the 24th September 1880.*—*Mr. C. Bageshawe*, who in Notification No. 55F., dated the 23rd January last, was appointed to officiate as a Deputy Conservator of Forests of the 2nd Grade in the Hyderabad Assigned Districts, is appointed to officiate as a Conservator of Forests of the 4th Grade during the absence of *Mr. A. T. Drysdale*, or until further orders, with effect from the 1st April 1880.

2.—CALCUTTA GAZETTE—

July 12th, 1880.—*Mr. G. A. Richardson*, Assistant Conservator of Forests, 2nd Grade, in charge of the Buxa Division, is promoted to the 1st Grade of Assistant Conservators of Forests, with effect from the 1st April 1880.

Mr. E. G. Chester, Assistant Conservator of Forests, Chittagong Division, and *Mr. F. B. Manson*, Assistant Conservator of Forests, Kurseong Division, are promoted from the 2nd to the 1st Grade of Assistant Conservators, with effect from the 10th May 1880.

The 19th July 1880.—It is hereby notified, under section 19 of the Indian Forest Act (Act VII. of 1878), that the following tract of land in the Darjeeling District, which, in the notification of the 18th October 1879, under section 4 of that Act, it was proposed to constitute a reserved forest, shall from the 1st August next be a "Reserved Forest" under the said Act:—

PUGRAINGBONG.—*North.*—A Jhora separating the forest from the Goompahar Forest Reserve.
East.—A demarcated line from that Jhora to the Pagraingbong spur, and thence to the Nagri ridge at the head of the Kundongbong Jhora.
South and West.—A demarcated line along the crest of the Nagri spur.

The 23rd July 1880.—It is hereby notified under section 19 of the Indian Forest Act (Act VII. of 1878), that the following tract of land in the Darjeeling District, comprising part of the forest which it was proposed in the notification of the 28th July 1878 to constitute a reserved forest, under the name of the

"Juldoka Block," shall, from the 1st August 1880, be a "Reserved Forest" under the said Act:—

NORTHERN TOWN.—North.—A demarcated line running east and west from the junction of the Moorte river with the Khoomance Jhora to the Juldoka river.

East.—The Juldoka river.

South.—The Julpigori district boundary.

West.—The Moorte river.

The 9th August 1880.—It is hereby notified that the Lieutenant-Governor has been pleased to declare the provisions of Chapter IV. of the Indian Forest Act, 1878, to be applicable to all forest and waste-lands in the Government estate of Khorda, in the district of Pooree, excepting such lands as have been confirmed as revenue-free or settled with cultivators or others, and such lands as shall, during the course of the revenue settlement now in progress or thereafter, be so settled.

The 12th August 1880.—It is hereby notified, under section 19 of the Indian Forest Act (Act VII. of 1878), that the following tracts of land in the Darjeeling district, which, in notification of the 18th October 1879, under section 4 of that Act, it was proposed to constitute reserved forests, shall, from the 1st September, next, be "Reserved Forests" under the said Act:—

1.—Mamring (an addition to the Sukna-Tista Forest). **North.**—The ridge separating the valley of the Mahanadi from that of the Reyang.

East.—The Mana Jhora.

West.—The east boundary of the Mahalderam tea estate, being a demarcated line, and stream tributary to the Mana Jhora.

2.—Babookhola. **North.**—A demarcated line along the ridge separating the valley of the Mahanadi from that of the Reyang.

East.—The west boundary of the Mahalderam tea estate, being a demarcated line, then a stream tributary to the Mahanadi river.

South.—A demarcated line separating the forest from Captain E. T. Fitzgerald's land, and passing from the Mahanadi river in a south-west direction to the Buffoonpance, then the Buffoonpance to its junction with the Mahanadi.

West.—The Mahanadi river then a stream to the south-east boundary line of the Majna tea estate (Mr. W. C. Muller's block), then the demarcated boundary of that estate to its north-west corner, then a stream running into the Mahanadi river, then that river, then a demarcated line running north-east to the Buffoonpance, and separating the forest from Jaman Sing's land, then the Buffoonpance, then a demarcated line to the old military road.

3.—Tookria Jhar. **North.**—A demarcated line from the edge of the plateau south of Dangy Jote to the Kemchi nadi, where it forms the boundary of the Hoodoobhita Jote.

East.—The Kemchi nadi, then a demarcated line separating the forests from jotes Mahomed Dsorbox and Soobul.

South.—A demarcated line separating the forest from jotes Dangurbhita, Charla, Munjoy, Huldur, Doolal Dass and Gundagole.

West.—A demarcated line separating the forest from jotes Hajaroo, Futeh, Dowlut, Gour Singh, Hamdhun, Prosadeo, Chamroo and Boungy.

4.—Moolta (an addition to the Dalka Jhar Reserve). **North.**—A demarcated line from the Jibhodar nadi south of Jhabra Jote to the Forest Reserve boundary.

East.—The Forest Reserve, then the Dalka nadi, then a demarcated line separating it from jotes Sham Lal (2) and Raghoob, then the Lalpa nadi to its junction with the Jibhedhar.

West.—The Jibhodar nadi to its junction with the west branch of the Moolta nadi, then a demarcated line separating the forest from the Jhakoodadura and Omeo Jotes, then the Jibhodar nadi.

5.—Rishabari, Major Wardroper's and Kanoo Choudry's Bhita Jotes (additions to the Dalka Jhar Reserve). On all sides Government Forest Reserve.

6.—Bengdubi (an addition to the Dalka Jhar Reserve). **North.**—Forest reserve.

East.—A demarcated line following the bed of the old Balasun river and skirting jotes Bownee Bhita (26) and Dhemsal, then a demarcated line south of the last named jote and west of jote Tarabari, then again a line following the bed of the old Balasun river and skirting jotes Bownee Bhita (24) and (22).

South.—A demarcated line from the old Balasun river to the Hurlia river, separating the forest from jotes Henglall Powa, Barobhita, Dhuniram, Bengdubi and Byrauti Baul.

West.—The Forest Reserve.

7.—Shilbhina Jote (an addition to the Sukna Tista Forest).—On all sides Government Forest Reserve.

8.—Nipania (an addition to the Mechi Forest). *North.*—The Lohargarhi Forest Reserve, then a stream leaving the reserve at its southernmost point, then a line running eastwards to the Aolia Manjha nadi.

East.—The Aolia Manjha nadi, then a line skirting the Nipania tea estate.

South.—A demarcated line to the Kaja Pounri nadi, then that stream, then a demarcated line to the new Mechi river.

West.—The Mechi Forest Reserve.

9.—Gurabadi (an addition to the Mechi Forest Reserve).—*North.*—The Mechi Forest Reserve.

East.—A demarcated line following the bed of the new Mechi river.

South.—A demarcated line to the old Mechi river, separating the forest from Jote Soorjbur.

West.—The Nepal frontier.

The 23rd August 1880.—The services of *Mr. L. G. Smith*, Sub-Assistant Conservator of Forests, attached to the Darjeeling Division, are placed at the disposal of the Government of the Punjab.

The 30th August 1880.—Under the provisions of the notification of 16th August 1880, in which persons desirous of transporting any forests produce through the Sunderbuns forests are required to take out a pass at one of the forest toll stations, paying such fees as may be fixed by the Conservator of Forests, it is hereby notified that the fees payable for such passes will, from the 1st September 1880, be the following:—

For Sundri timber, 2 pie per maund.

For all other forest produce, half pie per maund.

The 12th September 1880.—The Lieutenant-Governor is pleased to order that, on and after the 1st October 1880, the following shall be the rates for forest produce in the Sunderbuns Protected Forests, in supersession of those published in Rule I. of the Rules of the 17th August 1880:—

(1) On every maund of sundri,
pussur, or amoor timber... one anna.

(2) On every maund of keora
timber ... one-half anna.

(3) On every maund of any
other forest produce ... one-quarter anna.

The 12th September 1880.—The Lieutenant-Governor is pleased to notify, under section 75 of the Indian Forest Act (VII. of 1878), that on and after the 1st October next, any persons trading in timber or forest produce, or desirous of purchasing and removing forest produce from the reserved and protected forests of the Sunderbuns, may, if they so desire, and in place of having their boats as heretofore measured on every occasion that they enter or leave those forests, or pass any of the forest toll-stations, have their boats measured once for all, and such measurement registered

by the Deputy Conservator of Forests or his subordinate at any of those toll-stations, viz.—

- | | |
|-----------------|----------------------------|
| 1. Lower Bhola. | 9. Isreepore (Eshamuttee). |
| 2. Upper Bhola. | 10. Bussuntpore. |
| 3. Pussur. | 11. Roymangal. |
| 4. Khulna. | 12. Mutlah. |
| 5. Bhudder. | 13. Bogee. |
| 6. Shupsah. | 14. Saterbag. |
| 7. Koyrah. | 15. Tangara-khal. |
| 8. Cobaduk. | 16. Samukpatha. |

Such registration will hold good for the period of one year, and may be renewed after the expiry of that period.

Any boat, the measurement of which is so registered, will not be liable to further remeasurement or detention, either within the forests or at the forest toll-stations, provided—

- (1) That the boat does not contain any forest produce other than that entered in the permit; and
- (2) That the load does not exceed the registered burden, as shown by the mark on the water-line.

All boats registered will have the maundage and date of measurement painted in letters not less than 4 inches long on both sides of the bow; and amidships on either side will be painted the water-line, or line showing the loaded draft. This last will be indicated by a circle painted in white, intersected by a red line marking the depth to which the boat may be loaded. This line will be fixed at the pleasure of the manjee before measurement is made, and the measurement will be made accordingly.

The fees payable when a boat is registered for the first time shall be according to the following scale:—

		Rs. As. P.		
Boats not exceeding	50 maunds ...	0	4	0
Above 50 and not exceeding 100	„ ...	0	8	0
„ 100 „ „ 500	„ ...	0	12	0
„ 500 „ „ 1,000	„ ...	1	8	0
„ 1,000 „ „ 2,000	„ ...	2	0	0
„ 2,000 „ „ 3,000	„ ...	3	0	0
„ 3,000 „ ...	„ ...	4	0	0

On renewal of the registration after the expiry of twelve months, fees shall be payable at half the rates given in the above scale, provided that application is made for such renewal of registration within two months of the expiry of the said twelve months. After that period the full fees will be payable as for fresh registration.

The 20th September 1880.—Notice is hereby given that from the 1st October 1880, the following will be the rates for removal of forest produce from the Sunderbuns

reserved forests in supersession of those published in the *Calcutta Gazette* of August 1876, Part II, page 790:—

On every maund of sundri, pussur, or amoor timber, one anna.

” ” keora timber, one-half anna.

” ” any other produce, one-quarter anna.

The 22nd September 1880.—In supersession of the notification published at page 1230 of Part II of the *Calcutta Gazette* of 8th September 1880, and dated 30th August 1880, it is notified that, under the provisions of the notification of the 16th August 1880, in which persons desirous of transporting any forest produce through the Sunderbuns forest toll-stations, paying such fees as may be fixed by the Conservator of Forests, it is hereby notified that the fees payable for such passes will, from the 1st October 1880, be the following:—

For sundri, pussur or amoor timber, 2 pies per maund.

For keora timber ... 1 ” ”

For all other forest produce ... $\frac{1}{2}$ ” ”

3.—NORTH-WESTERN PROVINCES AND OUDH GAZETTE—

No. 690.—*The 5th July 1880.*—*Appointments.*—*Mr. J. S. Battie*, Sub-Assistant Conservator, to the charge of the Kheri Division.

No. 687.—*The 5th July 1880.*—*Transfer.*—*Mr. S. E. Wilmot*, Assistant Conservator, from the Kheri Division, Oudh Circle, to the Ganges Division, Central Circle.

No. 702.—*The 7th July 1880.*—In exercise of the power conferred by Sections 25 and 75 of the Indian Forest Act (VII.) of 1878, the Hon'ble the Lieutenant-Governor of the North-Western Provinces and Chief Commissioner of Oudh is pleased to prescribe the following rules to have effect in the Government forests of the Dehra Dun district:—

I.—In the undermentioned forests the inhabitants of the undermentioned villages shall be permitted—(a) to collect head-loads of fallen dry wood for fuel, under passes signed by such officer of the Forest Department as may be authorised in that behalf by the Conservator of Forests, which passes shall be granted without payment; and (b) on payment of the rates prescribed in No. III. of these rules, to graze the number of cattle specified opposite the name of each village:—

Number.	Name of Forest.	NAME OF VILLAGE.	Number of buf- faloes.	Number of cows and bullocks.	Number of don- keys and po- nies.	Number of sheep and goats.
1	Ambári.	Dumet ...	10	200	...	...
2		Katta Pathar ...	4	60	...	...
3		Mihunwála ...	8	150	...	...
4		Tauli ...	16	75	...	...
1	Chándpur.	Sahanspur ...	108	500	25	...
2		Dhaki ...	10	140	12	125
3		Abdullapur ...	4	50	...	...
4		Karimpur ...	40	80	...	...
5		Rámsahaiwála ...	2	60	...	...
6		Hurawála ...	55	235	15	50
7		Tilwári ...	4	100	...	...
1	Dholkot.	Jhájra ...	25	500	10	200
2		Mahra-ki-gaon ...	3	80	3	...
3		Sudhonwála ...	10	50	...	20
4		Dholkot ...	...	24	...	...
5		Mánduwála ...	16	150	...	...
6		Naugaon ...	8	130	...	...
7		Bhauwála ...	10	150	20	...
8		Rájawála ...	12	125	...	...
9		Grant Bakhtáwarpur ...	14	135	...	...
10		Bhagwánpur Jula ...	8	120	...	...
1	Nágsidh.	Nawáda ...	5	105	...	...
2		Dudhli ...	6	125	...	...
3		Balindwála Nagla ...	...	60	...	...
4		Phánda ...	4	30	...	...
5		Muhammadpur ...	4	45	...	...
6		Pandit Nágál... ..	10	75	...	...
7		Kishenpur ...	...	36	...	...
8		Májri ...	16	140	5	...
9		Badripur ...	28	160	...	...
10		Mahokampum (Khurd) ...	5	180	...	...
11		Mothronwála ...	35	200	5	...

II.—In the Western Siwalik forest the inhabitants of the villages named below shall be permitted—(a) to collect head-loads of fallen dry wood for fuel, under passes signed by such officer of the Forest Department as may be authorised in that behalf by the Conservator of Forests, which passes shall be granted without payment; and (b) on payment of the rates prescribed in No. III. of these rules, to graze the number of cattle mentioned opposite the name of each village. But any portion of this forest, not exceeding one-half of its total area, may be closed against the exercise of these privileges by the

Conservator of Forests with the sanction of the Superintendent of the Dehra Dun, provided that the portions left open for grazing, and for the collection of fuel are situated within a reasonable distance from the villages :—

Number.	Name of Forest.	NAME OF VILLAGE.	Number of buf- faloes.	Number of cows and bullocks.	Number of don- keys and po- nies.	Number of sheep and goats.
1	Western Siwálka.	Mahobáwála ...	26	50	...	...
2		Sheola Khurd ...	8	60	...	...
3		Sheola Kalan ...	50	260	...	...
4		Májra ...	50	225	10	...
5		Pithuwála ...	10	40	...	...
6		Mihanwála ...	50	300	4	60
7		Harbajwála ...	15	300	...	...
8		Malhán ...	18	260	...	...
9		Grant Carbery ...	8	100	...	...
10		Pelion ...	10	250	...	...
11		Kándli with Haripur ...	60	300	10	260
12		Shisambári ...	40	340	...	...
13		Hassanpur ...	4	50	...	...
14		Sherpur ...	15	90	...	...
15		Sangtiawála ...	45	290	...	...
16		Tiparpur ...	...	40	...	...
17		Kaliánpur ...	4	32	...	...
18		Játanwála ...	4	30	...	...
19		Májri ...	10	150	...	...
20		Timli with Chari Beli ...	65	246	22	250
21		Dharmawála ...	40	50	...	...
22		Shápúr ...	25	170	...	...
23		Aduwála ...	50	190	8	...
24		Kunja Grant ...	18	180	5	...
25		Kunja Khárgi ...	14	120	3	...
26		Kolal Matak Májri ...	100	200	...	...

III.—The rates chargeable to the inhabitants of the villages mentioned in Rules I. and II., for the grazing of cattle during a period of twelve months, are as follows :—

Buffaloes, four annas each ; cows and bullocks, two annas each ; donkeys and ponies, one anna each ; sheep and goats, six pies each.

IV.—In the undermentioned forests the roads specified shall not be closed :—

NAME OF FOREST.	Name of roads and water-courses.
Western Siwálíks ...	Asarori road.
Ditto ...	Khujnáur pass.
Ditto ...	Watercourse to Dehra Dún Tea Company and Carbery grant.
Ditto ...	Timli road.
Ditto ...	Road from Khúrja to Fyzabad, <i>viâ</i> Kolál.
Ambári ...	Road from Rudarpur to the Jumna.
Chándpur...	Road from Harawála to Sahanspur.
Dholkot ...	Road from Dunga <i>viâ</i> Mánduwála to Jhájra.
Nágsidh ...	Road from Dudhli to Manduwála.
Tírsál ...	Road from Ránipokhri to Khari.
Ditto ...	Road from Ránipokhri to Jogiwála.
Saura—Saroli, Kachar, and Tháno.	Road from Dehra to Tháno.
Sóng ...	Water-course leading to Markham grant.
Ditto ...	Road from Jiwangarh and Fatehpur to Markham grant.
Tírsál and Sainkot ...	Road from Lachiwála <i>viâ</i> Ránipokhri to Rikhesh.
Tháno ...	Road from Tháno to Sangtiawála.
Ditto ...	Road from Tháno to Bogpur.
Eastern Siwálíks ...	Khansrau Pass road.
Ditto ...	Road from Dehra to Hardwar.

This cancels the notification published at page 5 of the *North-Western Provinces and Oudh Gazette*, dated the 13th March 1880.

No. 754.—*The 14th July 1880.*—The Hon'ble the Lieutenant-Governor and Chief Commissioner is pleased to direct the transfer of Chandi and Patri Forests from the control of the Superintendent, Roorkee Workshops, to that of the Forest Department.

No. 755.—*The 14th July 1880.*—With reference to the above Notification, the Hon'ble the Lieutenant-Governor and Chief Commissioner is pleased to direct that the Chandi forests shall form part of the Ganges Division of the Central Circle, and shall be in charge of the officer in charge of the Ganges Division.

No. 756.—*The 14th July 1880.*—The Patri forests shall form part of the Saharanpur Division of the School Circle, and shall be in charge of the officer in charge of the Saharanpur Division.

The above changes will have effect from the date of making over charge.

No. 773.—*The 16th July 1880.*—The following rules made by the Hon'ble the Lieutenant-Governor, North-Western Provinces, and Chief Commissioner, Oudh, under the provisions of Section 31 of the Indian Forest Act (VII.) of 1878, for the protected forests

of Naini Tal, Ranikhet, and Lalitpur, having received the sanction of the Governor-General in Council, are hereby published for general information. These rules supersede all previous rules relating to the said forests :—

I. All words used in these rules and defined in Act VII. of 1878, (the Indian Forest Act) shall be deemed to have the meaning respectively attributed to them by the said Act.

II. Persons whose rights have been recorded under section 28, Act VII. of 1878, must submit their indents for building timber and for wood for agricultural purposes to the officer in charge of the Forest Division within the following periods :—

In the Naini Tal and Ranikhet } Between the 1st July and 31st October.
protected forests.

In the Lalitpur protected } From 1st February to 31st March, and
forests. } from 1st August to 30th September.

III. Licenses to purchasers felling or removing trees, or timber, or other forest produce, will be granted at such time and place, and at such rates and under such conditions, as may from time to time be fixed by the Conservator of Forests.

IV. The poisoning of water is prohibited.

V. Except with the written permission of the officer in charge of the Forest Division, no person shall set snares or traps.

VI. The Conservator of Forests may, with the previous sanction of the local Government, declare and publicly notify any part of the forest to which these rules relate to be closed altogether against hunting or shooting at such seasons and for such period, as he may deem necessary, or to be closed against the hunting or shooting of any class or classes of animals during certain seasons.

VII. Between the 1st April and the 31st August, both inclusive, in each year, the hunting and shooting of game birds of the following

kinds is prohibited :—

Partridges	Spur-fowl.
Pheasants.	Bustards.
Pea-fowl.	Floricane.
Jungle-fowl.	Sand-grouse.

VIII. The driving of game in the snow is prohibited.

IX. Subject to the restrictions contained in rules IV. to VIII., hunting, shooting, and fishing are permitted ; but nothing in this rule shall be taken to exempt any person from liability in respect of any offence by fire, injury to the forest, or its produce, or other offence punishable by section 32 of Act VII. of 1878.

X. Trespassing, pasturing cattle, or permitting cattle to trespass in such portions of the forests as may have been closed under section 29 (b) of the Indian Forest Act, is prohibited.

No. 778.—*The 17th July 1880.*—In exercise of the powers conferred by Section 34 of the Indian Forest Act, 1878, the Hon'ble the Lieutenant-Governor, North-Western Provinces, and Chief Commissioner, Oudh, is pleased to declare the lands described in Schedule A, hereto annexed, to be reserved forests :—

SCHEDULE A.

District.	Pargana.	Name of Forest.	Description of boundaries.
KHERI.	Bhūr.	Madha Dih, block A.	This land, formerly known as Madha (had-bast No. 213 A.), is bounded on the north-west by Madha Dih forest, on the north-east by the Kaptowra forest, and on the south by Seth Gobind Das' grant (formerly jungle nazul No. 3.)
		Kaptowra, block A.	This land, formerly known as Bhadeora (had-bast No. 188A.), is bounded on the east by Bhira, north, south, and west by the Kaptowra forest.

Madha Dih Forest, block A., and Kaptowra Forest, block A., will henceforward form portions of the Madha Dih Forest and Kaptowra Forest, respectively, as gazetted in Notification No. 194, Government, North-Western Provinces and Oudh, Revenue (Forests) Department, dated Allahabad, 28th February 1879.

No. 786, 17th July 1880.—In exercise of the powers conferred by Sections 25 and 75 of the Indian Forest Act, VII. of 1878, the Hon'ble the Lieutenant-Governor, North-Western Provinces, and Chief Commissioner, Oudh, is pleased to prescribe the following rules to have effect in the Government Forests of the Saharanpur District:—

I. The inhabitants of the undermentioned villages shall have the privilege of grazing the number of cattle, sheep, and goats specified opposite the name of each village, at the rates mentioned in No. II. of these rules, viz. :—

Name of Village.	Number of cattle.	Number of sheep and goats.	REMARKS.
Raoli Mahdud ...	500		
Banswali ...	115		
Ahmedpur Khurch ...	675		
Rajpur ...	290		
Salempur ...	300		
Aurangabad ...	600		
Aneki Kalan...	200		
Nagal ...	95		
Sherpur Pelon ...	310	50	
Hahibpur ...	195		
Haderpur. <i>alias</i> Haidowara	50		
Indarpur Talra ...	100		
Barkala ...	250		
Rampur ...	230	60	
Bugawala <i>alias</i> Ferozepur	240		
Naukra ...	657	...	Including 3 abadis, viz., Naukra, Tanda, Arjan, and Tanda Juara.

II. The rates chargeable to the inhabitants of the villages mentioned in rule I., for the grazing of cattle, sheep, and goats, for a period of twelve months, are as follows:—

Buffaloes	...	...	4 annas each.
Cows and bullocks	...	...	2 " "
Sheep and goats	...	...	6 " "

III. When closing any portion of the forests in the Saharanpur District, the Conservator of Forests must, in consultation with the Collector, provide conveniently situated grazing-grounds for the cattle mentioned in Rule I.

No. 781.—*The 17th July 1880.*—In clause (c) of this department Notification No. 300, dated the 28th February 1880, the words "in the Bijnor district" after "Bijnor to Muzaffarnagar" should be struck out.

No. 854.—*The 28th August 1880.*—In the notification from this Department, No. 301, dated the 28th February 1880, in column 2 of the statement given in para. 2, for "33" read "31 and 33" wherever those figures occur.

No. 868.—*The 1st September 1880.*—In the notification from this Department, No. 301, dated the 28th February 1880, in the 1st column of the statement in para. 2, and in the 2nd class of officers empowered, after "and foresters" read "*and all other forest officers* when specially authorised," &c.

The 8th September 1880.—In exercise of the powers conferred by section 19, Act VII. of 1878, the Hon'ble the Lieutenant-Governor of the North-Western Provinces and Chief Commissioner of Oudh, is pleased to declare the forests specified in the following schedule to be reserved forests, and to form, with the Ramgarh grants, a new forest, to be named the Nawabgunj forest:—

JAIPUR East.—Mauza Gohunia, Pargana Manikapur.

West.—Mauza Shambhunagar and Surjapur, Pargana Nawabganj.

North.—Mauza Korondi, Pargana Mahadewa, and Mauza Bhitara, Pargana Manikapur.

South.—Mauza Mahadewa, Pargana Nawabganj.

SHAMBHUNAGAR East.—Mauza Jaipur and the Mahal of Ali Muhammad, included in Shambhunagar, Pargana Nawabganj.

West.—Mauza Amarpur, Pargana Manikapur and the Mehal of Raja Kishen Dat Ram, included in Shambhunagar.

North.—Mauza Bhitara, Pargana Manikapur.

South.—Mauza Hardowa and Ramgarh grant, Pargana Nawabganj.

No. 910.—*The 15th September 1880.*—Mr. R. S. Dods-worth reported his return to duty on the 30th August 1880, from the leave granted to him in this department Notification, No. 313, dated the 8th April 1879, and assumed charge of the Kheri Division on the afternoon of the 2nd September 1880.

4.—PUNJAB GAZETTE—

No. 266F.—*The 5th July 1880.—Leave.*—*Mr. F. D' A. Vincent*, Assistant Conservator of Forests, Plantation Division, has obtained privilege leave of absence for three months, in continuation of the Examination leave granted to him in *Punjab Government Gazette*, Notification No. 184F., dated 22nd April 1880.

No. 267F.—*Notification.*—In continuation of *Punjab Government Gazette* Notification No. 185F., dated 22nd April 1880, *Mr. E. A. Down*, Assistant Conservator of Forests, will continue in charge of the Plantation Division during *Mr. Vincent's* absence on leave.

No. 283F.—*The 19th July 1880.—Notification.*—Under instructions from the Government of India, the services of *Mr. E. McA. Moir*, Assistant Conservator of Forests, are placed at the disposal of the Government, North-Western Provinces and Oudh, with effect from the date of his return from the leave, granted to him in Notification No. 279F., dated 13th March 1879, by the Government of India, in the Department of Revenue, Agriculture, and Commerce.

No. 301F.—*August 1880.*—The Lieutenant-Governor is pleased, under Section 28 of Act VII. of 1878 (The Indian Forest Act), to declare the lands in the following Schedule to be protected forests, and the provisions of Chapter IV. of the said Act to be applicable thereto.

Under Section 29, the Lieutenant-Governor declares all trees to be reserved in the said forests from the date of this notification.

The Lieutenant-Governor prohibits the breaking up of land for cultivation, or for any other purpose, and the quarrying of kankar, except according to rules relating to the subject under Section 31 of the said Act, from the date of this notification.

Under Section 31, the Lieutenant-Governor prescribes the following rules:—

1. The general management of the protected forests is vested in the officers of the Forest Department, in communication with the Deputy Commissioner of Gujranwála.

2. The grazing right will be sold by annual leases in the manner heretofore customary, and all other grazing (except in pursuance of a right) is prohibited.

3. The quarrying kankar and breaking up of land for any other purpose, without the written permission of the Deputy Commissioner, and countersignature of the Forest Officer, is prohibited.

4. The lopping and tearing down of branches of trees and the cutting of trees is prohibited except with the permission in writing of the Forest Officer.

Descriptive statement showing boundaries of protected forests.

Háfizabad North.—Village lands of Manjít and reserve Bhikolohári (Block XI.); also village lands of Sukeki, Khánwánwáli, Nawa Khona,

Amaltás, Par Massu marrah, Par Massu Chidaránwála, Hindwánáh and Beriwaláh.

South.—Reserve Kamawáli (Block IV.)

East.—Forest reserves, (Block V.) Kamálwáli and village lands of Manaawáli, also Blocks VI, VII, VIII, IX and X=Lagar, Ratti Tibbi, Gajána, Kingráwali, Daban.

West.—Jhang "protected forests."

N.B.—The boundaries are taken from the Revenue Survey Map of 1852-55.

No. 318F.—*The 10th August 1880.—Leave.*—*Mr. W. Shakespeare*, Assistant Conservator of Forests, Fuel Reserve, South Division, has obtained privilege leave of absence for three months, with effect from the afternoon of the 22nd July 1880.

No. 319F.—*Appointment.*—*Mr. A. M. Reuther*, Officiating Assistant Conservator of Forests, attached to the Conservator's Office, is appointed to the charge of the Fuel Reserve, South Division, during the absence on leave of *Mr. Shakespeare*.

No. 320F.—*Transfer.*—*Mr. L. G. Smith*, Sub-Assistant Conservator of Forests, transferred from Bengal to the Punjab, is attached to the office of the Conservator of Forests, Punjab, as a temporary measure, with effect from the afternoon of the 14th July 1880, *vice Mr. Reuther*.

No. 324F.—*The 11th August 1880 —Examination.*—*Mr. F. D'A. Vincent*, Assistant Conservator of Forests, 1st Grade, passed an examination in Punjabi, held on the 10th July 1880.

No. 345F.—*The 26th August 1880.—Notification.*—In supersession of *Punjab Government Gazette* Notification No. 301F., dated 24th July 1880, the Lieutenant-Governor is pleased, under Section 28 of Act VII. of 1878 (The Indian Forest Act), to declare the lands in the following Schedule to be protected forests, and the provisions of Chapter IV. of the said Act to be applicable thereto.

Under Section 29, the Lieutenant-Governor declares all trees to be reserved in the said forests from the date of this notification.

The Lieutenant-Governor prohibits the breaking up of land for cultivation, or for any other purpose, and the quarrying of kankar, except according to rules relating to the subject under Section 31 of the said Act, from the date of this notification.

Descriptive Statement showing boundaries of protected forests.

Háfizabad North.—Village lands of Manjít and reserve Bhikolohári (Block XI.); also village lands of Sukeki, Khánwánwáli, Nawa Khona, Amaltás, Par Massu Marrah, Par Mussu Chidaránwála, Hindwánáh and Beriwaláh.

South.—Reserve Kamawáli (Block IV.)

East.—Forest reserves, (Block V.) Kamálwáli and village lands of Mánánwáli; also Blocks VI, VII, VIII, IX and X. *vis.*—Lagar, Ratt Tibbi, Gajána, Kingráwali, Daban.

West.—Jhang “protected forests.

N.B.—The boundaries are taken from the Revenue Survey Map of 1852-55.

No. 348.—*The 27th August 1880.*—*Notification.*—*Mr. A. E. Wild*, Deputy Conservator of Forests, transferred to the Punjab, by Notification of the Government of India, in the Home, Revenue and Agricultural Department, No. 243F., dated 27th April 1880, is appointed to the charge of the Gujranwala Division, with effect from the afternoon of the 28th July 1880, *vice Mr. C. F. Rossiter.*

No. 349F.—*Notification.*—*Mr. C. F. Rossiter*, Sub-Assistant Conservator of Forests, is, on being relieved of the charge of the Gujranwala Division, posted to the Jhelum Division.

No. 372F.—*The 9th September 1880.*—*Leave.*—In continuation of *Punjab Government Gazette Notification No. 242F.*, dated 16th June 1880, the undermentioned officer has been granted a further extension of leave by Her Majesty's Secretary of State for India, as advised in list, dated 6th August 1880 :—

NAME.	Service.	Appointment.	Period and nature of extension.
W. Rigny ...	Uncovenanted.	Assistant Conservator of Forests, 1st Grade.	1½ months' sick certificate.

No. 374F.—*The 16th September 1880.*—*Notification.*—With reference to *Punjab Government Gazette Notification No. 349F.*, dated 27th August 1880, *Mr. C. F. Rossiter*, Sub-Assistant Conservator of Forests, joined the Jhelum division on the forenoon of the 5th August 1880.

No. 381F.—*The 20th September 1880.*—*Leave.*—*Mr. C. F. Elliot*, Officiating Deputy Conservator of Forests, resumed charge of the Rawalpindi division on the forenoon of the 3rd September 1880, on return from privilege leave of absence, granted to him in *Punjab Government Gazette Notification No. 255F.*, dated 25th June 1880, relieving *Mr. J. S. Makay.*

5.—CENTRAL PROVINCES GAZETTE—

No. 2561.—*9th July 1880.*—*Mr. E. D. M. Hooper*, Assistant Conservator of Forests, is granted three months' privilege leave, with effect from the 15th instant, or such subsequent date on which he may avail himself of it.

No. 2611.—*16th July 1880.*—Two years' furlough to Europe, under Chapter IV., Section 21 of the Civil Leave Code, is granted to *Mr. W. P. Thomas*, Assistant Conservator of Forests, 1st Grade, with effect from 23rd March last, the date on which that officer sailed from Bombay per Steamer "*Rydal Hall*."

No. 2703.—*21st July 1880.*—*Mr. E. D. M. Hooper*, Assistant Conservator of Forests, 1st Grade, availed himself of the three months' privilege leave granted him by Notification No. 2561 of 9th instant, on the afternoon of the 15th idem.

No. 2852.—*Dated Nagpur, the 3rd August 1880.*—*Captain C. W. Losack*, Deputy Conservator of Forests, assumed charge of the 1st Class Reserves of the Jubbulpore Forest Division on the 31st January last.

No. 3228.—*The 3rd September 1880.*—*Mr. R. H. C. Whittall*, Deputy Conservator of Forests, transferred from British Burmah to these Provinces, reported his arrival at Hoshangabad, and assumed charge of that Forest Division, and the 1st Class Reserves of the Betul Division from Forest Ranger *Muhammad Ghouse* on the forenoon of the 11th August last.

6.—BRITISH BURMAH GAZETTE—

No. 291.—*6th July 1880.*—At the examination held in Rangoon, on the 7th June 1880 and following days, the undermentioned officers passed the examination in the Burmese language, prescribed in Notification No. 202, dated the 19th September 1876 :—

Lower Standard.

Mr. N. Hearle, Assistant Conservator of Forests.

Mr. A. Weston, Sub-Assistant Conservator of Forests.

No. 55.—*The 6th August 1880.*—Under the provisions of Section 44 of the Civil Leave Code, *Mr. J. Nisbet*, Assistant Conservator of Forests, is granted privilege leave for two months and twenty-eight days, with effect from the date on which he may avail himself of it.

No. 61.—*The 2nd September 1880.*—*Captain C. T. Bingham*, Officiating Deputy Conservator of Forests, reported his return, at Moulmein, on the 22nd ultimo, from the three months' privilege leave of absence granted to him in this Department Notification No. 35, dated the 29th April 1880.

7.—ASSAM GAZETTE—

No. 187.—*The 16th July 1880.*—Privilege leave of absence for three months, under Section 13, Supple-

ment F., of the Civil Leave Code, is granted to *Mr. H. G. Young*, Sub-Assistant Conservator of Forests, Cachar, from the 15th August 1880, or from the subsequent date on which he may avail himself of the same.

No. 207.—*The 9th August 1880.*—*Mr. W. E. D'Arcy*, Assistant Conservator of Forests, 1st Grade, Sibságar, is transferred to the district of Lakhimpur, and is appointed to have charge of the Lakhimpur Forests Division. *Mr. D'Arcy* made over charge of the Sibságar Forest Division to *Mr. C. G. D. Fordyce*, Assistant Conservator of Forests, 3rd Grade, on the afternoon of the 28th July 1880.

No. 18.—*The 10th August 1880.*—The Chief Commissioner is pleased to prescribe the following rates of royalty to be paid on timber floated on any river in the Valley Districts of Assam, and which is the property of Government, or was produced on Government land, or on lands belonging to, or in the occupation of, private persons on which Government has the right to levy a royalty, and on which the royalty, or duty, or purchase-money has not been paid already.—

Logs of Sál.

If under 10 feet in length, Rs. 2-8 per log.

If from 10 feet to 15 feet in length, Rs. 5 per log.

If over 15 feet in length, Rs. 10 per log.

Logs of reserved kinds of wood.

If under 10 feet in length, Re. 1-8 per log.

If from 10 feet to 15 feet in length, Rs. 3 per log.

If over 15 feet in length, Rs. 6 per log.

Logs of unreserved kinds of wood.

If under 15 feet in length, Re. 1 per log.

If over 15 feet in length, Rs. 2 per log.

Boats or dugouts.

If of Sál, Rs. 10 each.

If of other kinds, Rs. 6 each.

Bamboos.

Jungli or kata bamboo, Re. 1 per hundred.

Játi bamboo, Rs. 2 per hundred.

Bhaluka bamboo, Rs. 3 per hundred.

Charcoal, per maund, or for every nine cubic feet, 2 annas.

No. 19.—*The 10th August 1880.*—In exercise of the powers conferred by Section 41 of Act VII. of 1878 (The Indian Forest Act), the Chief Commissioner of Assam is pleased to make, and, with the sanction of the Governor-General in Council, to publish the following rules, which shall come into force on and from the 1st October 1880 :—

BHUTAN TIMBER RULES.

- I. All words used in these rules, and defined in Act VII. of 1878 (The Indian Forest Act) shall be deemed to have the meanings respectively attributed to them by the said Act.
- II. All timber which it is intended to import from Bhutan into or through the Province of Assam, shall be stopped for examination at the British boundary and be reported, to the District Forest Officer, or any other Forest Officer authorised in that behalf, and shall not be imported into the Province of Assam until it has been examined and marked.
- III. All timber brought down by the Langá, Gorápilá, Chámpámati or Gángiá rivers, or any of their tributaries in the district of Goálpára, shall be stopped for examination and be reported to the District Forest Officer or other Forest Officer authorised in that behalf, at the following places :—
Datma, on the Langá river;
Rajadabri, on the Gorápilá river;
Gurubasa, on the Chámpámati river;
Burimukh, on the Gángiá river;
 or at such other places as the Chief Commissioner may from time to time, by notification in the *Assam Gazette*, prescribe.
- IV. The District Forest Officer, or other Forest Officer, authorised in that behalf, shall, if requested to do so by the person in charge of timber so brought down, grant a pass for the same in such form as the Chief Commissioner may from time to time prescribe, and for the issue of which a uniform fee of 8 annas for each log, boat, or dugout will be levied.
- No person shall remove any timber from any place at which the same has been stopped under Rule III., until a pass has been granted, as prescribed in this rule.
- V. Should the person in charge of any timber, brought down the Langá, Gorápilá, Chámpámati, or Gángiá rivers, or any of their tributaries in the district of Goálpára, desire to land such timber before reaching any of the places prescribed under Rule III. as places for the stoppage thereof, they shall obtain the permission, in writing, of the District Forest Officer, or other Forest Officer as may be authorised in that behalf. If such officer deems fit to grant such permission, he shall examine the timber and shall grant a pass as prescribed in Rule IV.
- VI. Except with the permission in writing of the District Forest Officer, or such other Forest Officer authorised in that behalf, no timber in transit on the Langá, Gorápilá, Chámpámati, or Gángiá rivers, or any of their tributaries in the district of Goálpára, may be landed or removed inland, nor may such timber be cut up or converted before a pass has been granted by the Forest Officer for the same.
- VII. All timber when in transit in the Goálpára district, either by land or by river, may be stopped and examined by any Forest or Police Officer, and the persons in charge of such timber shall be bound to produce any passes which may have been granted to them, when called upon to do so by any Forest Officer or Police Officer.

VIII. Any person infringing any provision of these rules shall be punished, with imprisonment of either description, which may extend to six months, or with fine which may extend to five hundred rupees, or with both.

No. 20.—*The 10th August 1880.*—In exercise of the powers conferred by Section 41 of Act VII. of 1878 (The Indian Forest Act, 1878), the Chief Commissioner of Assam is pleased to make, and, with the sanction of the Governor-General in Council, to publish the following rules, which shall come into force on and from the 1st October 1880 :—

ASSAM RIVER RULES.

I. All words used in these rules, and defined in Act VII. of 1878 (The Indian Forest Act), shall be deemed to have the meanings respectively attributed to them by the said Act.

II. All timber and other forest produce, which is brought down by the Brahmaputra river, or any of its tributaries within the Province of Assam, shall be stopped for examination, and for the payment of the amounts, if any, due to Government thereon, whether as duty, royalty, or on any other account, at the following revenue-stations, *viz.* :—

Dibru Mukh, on the Brahmaputra river, in the Lakhimpur district ;

Dhubri, on the Brahmaputra river, in the Goalpara district ;

or at such other places as the Chief Commissioner may, from time to time, by notification in the *Assam Gazette*, prescribe.

III.—All amounts so due to Government shall be paid into the Dibrugarh or Dhubri Sadar treasuries, and the treasury receipt shall be handed to the Forest Officer, in charge of the revenue station, who shall thereupon, if requested to do so, by the person in charge of such timber or forest produce, grant a pass for the same in such form as the Chief Commissioner may, from time to time, prescribe, and for the issue of which fees will be levied as follows :—

- (1) For every raft of timber or bamboos, or boat carrying timber or bamboos, a fee of one rupee.
- (2) For every raft of cane, or boat carrying cane, a fee of eight annas.
- (3) For every raft of thatching-grass and reeds or ekra, or boat carrying the same, four annas.
- (4) For every raft or boat carrying charcoal, one rupee.

No person shall remove any timber or other forest produce from any place at which the same has been so stopped, until such pass has been granted by the Forest Officer in charge of the revenue station.

IV. Should the person in charge of any timber or other forest produce, brought down the Brahmaputra, or any of its tributaries in the Province of Assam, desire to land such timber or other forest produce before reaching any of the places prescribed under these rules as places for the stoppage thereof, and the persons in charge of such timber or other forest produce not be already in possession of a pass or license showing that payment of the amount due to Government thereon,

Grant of pass on payment of dues for landing timber and other produce before reaching a place referred to in Rule II.

Stoppage of timber for examination, and payment of dues at revenue stations.

Grant of passes for timber and other produce by the Forest Officer in charge of the revenue station, and the payment of fees on such passes.

whether as duty, royalty, or on any other account, has been made, they shall obtain the permission, in writing, of the District Forest Officer, or other Forest Officer duly authorised in that behalf. If such officer deems fit to grant such permission, he shall examine and measure the timber and other forest produce, and shall, on being handed the treasury receipt acknowledging payment of the amount due to Government thereon, grant a pass as prescribed in Rule III.

V. Except with the permission, in writing, of the District Forest Officer, or other Forest Officer duly authorised in that behalf, no timber or other forest produce in transit on the Brahmaputra river, or any of its tributaries in the province of Assam, may be landed or removed inland, nor may such timber be cut up or converted before the amount due to Government thereon has been paid, and

a pass has been granted for the same by the District Forest Officer or such other Forest Officer duly authorised in that behalf.

VI. All timber and other forest produce, which is brought down any river in the Valley Districts of Assam, may be stopped and examined by any Forest Officer or Police Officer, and the persons in charge of such timber or forest produce shall be bound to produce any passes which may have been granted to them for such timber or forest produce, when called upon to do so by such Forest Officer or Police Officer.

Stoppage and examination of timber, &c., by any Forest or Police Officer, and the production of passes.

VII. Any person infringing any provision of these rules shall be punished with rigorous or simple imprisonment for a term which may extend to six months, or with fine which may extend to five hundred rupees, or with both.

No. 220.—*The 30th August 1880.*—*Mr. H. G. Young*, Sub-Assistant Conservator of Forests, availed himself of the privilege leave, granted in Notification No. 187, of the 16th July 1880, and made over charge of the Cachar Division to *Mr. D. P. Copeland*, Sub-Assistant Conservator of Forests, on the afternoon of the 20th instant.

No. 245.—*The 23rd September 1880.*—*Mr. C. Mann*, Conservator of Forests, Assam, is allowed privilege leave of absence for three months, under Sections 41 and 42 of the Civil Leave Code, with effect from the 18th October 1880, or from the subsequent date on which he may avail himself of it.

No. 255.—*The 30th September 1880.*—*Baboo Jay Náráyan Dás*, Forest Ranger, received charge of the Tezpur Forest Division, on the afternoon of the 12th August 1880, from *Mr. Copeland*, transferred to the Cachar Division.

8.—MYSORE GAZETTE—

No. 9.—*The 8th July 1880.*—*Mr. F. B. Dickenson*, Assistant Conservator of Forests, Coorg, has passed the Higher Standard Examination in Kanarese, as laid down in G. G. O. No. 734 of the 9th September 1864.

No. 10.—*The 15th July 1880.*—*Mr. F. B. Dickinson*,

Assistant Conservator of Forests, Coorg, officiating in the 1st Grade, is confirmed in that grade from the 5th July 1880, the date of his passing the Higher Standard Examination in Kanarese, under the provision contained in para. IV. of the Circular Resolution of the Home, Revenue and Agricultural Department, No. 5F., dated 23rd February 1880.

No. 14.—*The 15th September 1880.*—*Mr. F. B. Dickenson*, Assistant Conservator of Forests, Coorg, returned to duty on the 1st instant, from the three months' examination leave granted him in Chief Commissioner's Notification, dated 10th May last.

9.—BOMBAY GAZETTE—

The 1st July 1880.—*Messrs. B. J. Haselden*, Sub-Assistant Conservator of Forests, and *W. A. Talbot*, Assistant Conservator of Forests, respectively delivered over and received Forest charge of the Yellapur Taluka and the Kanara Saw Mills, on the 21st June 1880, after office hours.

Messrs. J. C. Stobie and *W. R. Woodrow*, Assistant Conservators of Forests, respectively delivered over and received Forest charge of the Sirsi and Siddapur Talukas of the Kánara Collectorate, on the 17th June 1880, in the afternoon.

The 6th July 1880.—*Mr. Laruman Ballal Oka*, Acting Sub-Assistant Conservator of Forests, reported his arrival to the District Forest Officer, Khándesh, and received charge of the office of Sub-Assistant Conservator of Forests, Khándesh, on the 17th June 1880, before office hours.

The 8th July 1880.—*Mr. G. E. Hewett*, Assistant Conservator of Forests, reported his arrival for duty in Khándesh from the Panch Maháls, on the 30th June 1880, before office hours.

The 15th July 1880.—*Mr. G. R. Mahajan*, Sub-Assistant Conservator, and *Mr. H. Mainwaring*, Assistant Conservator of Forests, respectively delivered over and received charge of the Sátára District Forest Office, on the 12th instant, before office hours.

No. 3817.—*The 22nd July 1880.*—*Mr. G. Hewett*, Assistant Conservator of Forests, Khándesh, is allowed privilege leave of absence for three months.

The 27th July 1880.—*Messrs. G. A. Hight*, Assistant Conservator of Forests, and *S. Hornidge*, Sub-Assistant Conservator of Forests, respectively delivered over and received charge of the District Forest Office, Ahmednagar, on the 22nd July 1880, after office hours.

No. 3934.—*The 28th July 1880.*—*Mr. H. Mainwaring*,

Assistant Conservator of Forests, Sâtára, having returned to duty on the 12th instant, before office hours, the unexpired portion of the three months' privilege leave granted to him, and notified under Government Notification No. 3212, dated 21st June 1880, is cancelled.

No. 824.—*The 9th August 1880.*—The notification of this Government, in the Public Works Department, Forest Branch, No. 144F., dated the 29th March 1876, acquiring land in Dehra Dun for the Forest Department, is hereby cancelled.

No. 4133.—*Bombay Castle, 9th August 1880.*—Under the provisions of Section 41 of the Indian Forest Act No. VII. of 1878, His Excellency the Right Honourable the Governor in Council is pleased, with the previous sanction of the Government of India, to make the following rules for regulating the transit of timber and other forest produce :—

1. All words used in these rules and defined in Act VII. of 1878, (The Indian Forest Act) shall be deemed to have the meaning respectively attributed to them by the said Act.

2. No timber or other forest produce shall be moved into or from any of the districts in the Presidency of Bombay mentioned in Appendix A, except by the routes therein respectively specified.

3. No timber or other forest produce shall be moved within any district of the Bombay Presidency, except within the limits of a Reserved Forest (whether a Village Forest or not) or of a Protected Forest,

and, except as is hereinafter otherwise provided, no timber or other forest produce shall be moved from or into any such district,

without a pass from a Conservator of Forests, or from some officer empowered by a Conservator of Forests, or from some person duly authorized under Rule 13 to issue such pass, nor otherwise than in accordance with the conditions of such pass:

Provided that nothing in this rule shall be deemed—

(a) to apply to timber or forest produce which is the property of Government, or

(b) to apply to timber, or other forest produce, the property of one person, or the joint property of two or more persons, which is conveyed in quantities not exceeding one head-load once in twenty-four hours, or

(c) to require a pass for the removal of any timber or other forest produce within the limits of the village in which it was produced.

4. Every pass issued under the last rule shall specify :

(1) the name of the person to whom such pass is granted ;

(2) the quantity and description of timber or other forest produce covered by it ;

(3) the places from and to which such timber or other forest produce is to be conveyed, and the route by which it is to be conveyed ;

(4) the period for which such pass is to be in force ;

(5) the officer to whom it is to be returned on the expiry of such period, or on the arrival of the timber or other forest produce at its destination, whichever event happens the first.

5. In the case of timber or other forest produce which it is wished to import otherwise than by sea from any place beyond the frontier of

British India, no pass shall be issued under Rule 3 unless upon production of a "Foreign Pass" covering such timber, or other forest produce, nor, if such timber be of large scantling, unless it bears a Foreign Property-mark.

6. Every such Foreign Pass must be in a form, and every such Foreign Property-mark must be of a description, which has been registered in the office of the Conservator of Forests of the Division into which it is sought to import such timber, or forest produce, and such Foreign Pass must bear the signature of some officer or other person whose name has been duly registered in the said office as an officer or person duly authorized to sign such passes.

7. Any timber or other forest produce which it is wished to import otherwise than by sea from any place beyond the frontier of British India, may be conveyed within such frontier by any the routes named in Appendix A as far as the first depôt on such route established under Rule 15 without a pass under Rule 3, if it is covered, by a Foreign Pass in proper form and duly signed, and if, in the case of timber of large scantling, it is marked with a registered Foreign Property-mark, but not otherwise.

No such timber or forest produce shall be stacked, or deposited in any place between the frontier and such depôt, or be moved beyond such depôt without a pass issued under the said rule.

8. If the Conservator of Forests of the Division shall so direct, no timber of large scantling, which has been imported as aforesaid by any particular route, shall be moved beyond such first depôt without first having a Government transit mark of such description as the said Conservator shall prescribe stamped upon it.

9. In respect of every pass issued under Rule 3 there shall be payable such fee, if any, as the Conservator of Forests shall, from time to time, prescribe with the previous sanction of Government, for each district, and no such pass shall be issued until the fee so prescribed has been paid.

10. No person who belongs to a community to which a Village Forest is assigned and no inhabitant of a town or village in the vicinity of a Protected Forest, who is permitted to take timber or other forest produce from such forest for his own use, shall be entitled to receive a pass under Rule 3 for the removal of timber or forest produce from such forest to any place beyond the limits of the town or village in which such person resides:

Provided that in the district of Kanara a pass may be issued for moving from the said district any timber which has been given, on payment of the fees to be hereafter prescribed, for a specific purpose, and has been used by the grantee for that purpose,

but only on payment of an additional fee of fifty per cent. on the amount of the fee originally paid, if such timber is being moved by any person other than the original grantee,

unless the Collector, or the Conservator of Forests, or any of their Assistants or Deputies to whom an application may be made in this behalf, shall be satisfied that such timber is being moved for charitable purpose, and shall be of opinion that such additional fee should be reduced or remitted,

in which case a pass may be granted either without additional fee or on payment of a reduced fee, as the Collector or other officer aforesaid shall determine.

11. In every other case the owner of timber or other forest produce shall be entitled to receive a pass for the same under Rule 3 for any of the purposes for which such passes may be granted.

12. In the district of Kanara passes under Rule 3 for the moving of timber or other forest produce beyond the inland frontier of the said district will be issued in duplicate, one white and one green, and

the date of exit will be recorded upon each of such duplicate passes by the Forest Officer at the appointed watch-house on the frontier, and the green pass shall be surrendered by the holder thereof to such officer, who shall return it without delay to the office from which it was issued.

13. The Conservator of Forests may, if he thinks fit, at any time, by an order in writing :

(a) authorise any person who is an owner of timber or other forest produce, or the agent of any such owner, to issue passes under Rule 3 in respect of any timber or other forest produce which belongs to such person, or to the person for whom such person is agent, and

(b) cancel such authorization.

When the Conservator of Forests authorises any person under clause (a) of this rule, he shall furnish such person from time to time with authenticated books of blank printed forms of passes with the particulars required by clauses (4), (5), and (6) of Rule 4 already filled in, and no alteration shall be made by such person in any of the said particulars, or if made, shall have any validity.

The said person shall pay for each such book such sum as shall, from time to time, be determined by the Conservator of Forests, and in the event of an order being passed by the Conservator of Forests, under clause (b) of this rule, shall at once return to the said Conservator every unused book, and every unused portion of any such book then remaining in his possession, and shall be entitled to receive back the amount paid by him in respect of such unused book or portion of a book.

No pass issued by any such person, after the issue of an order, under clause (b) of this rule, and no pass issued by him, which is not on a form supplied to him as aforesaid, shall have any validity.

14. Timber or other forest produce in transit may be stopped and examined at any place by any Forest or Police Officer, if such officer shall have reasonable ground for suspecting that any money, which is payable to Government in respect thereof, has not been paid, or that any forest offence has been or is being committed in respect thereof.

The person in charge of any such timber or other forest produce, shall furnish to any such officer, all the information which he is able regarding such timber or other forest produce, and if he is removing the same under a pass, shall produce such pass, on demand, for the inspection of such officer, and shall not in any way prevent or resist the stoppage or examination of the said timber, or other forest produce by such officer :

Provided always that no such officer shall vexatiously or unnecessarily delay the transit of any timber or other forest produce which is lawfully in transit, nor vexatiously or unnecessarily unload any such timber or other forest produce, or cause the same to be unloaded, for the purpose of examination.

15. The Conservator of Forests may establish, at such convenient places, as he shall think fit, on the routes by which timber or other forest produce may lawfully be conveyed, depôts to which such timber or other produce shall be taken for all or any of the following purposes (namely) :—

for examination previous to the grant of a pass in respect thereof under Rule 3, or under Rule 13, or

for determining the amount of money, if any, payable on account thereof to Government, and for the payment of such money, or in order that any mark required by law, or by these rules to be affixed thereto, may be so affixed.

16. A Forest Officer, appointed by or under the orders of the Conservator, shall have charge of each such depôt, and no timber or other forest produce shall be brought into, stored at, or removed from a depôt,

without the permission of such officer, and for storing timber or other forest produce in such depôt, and allowing laden carts, or loads, or cattle, to stand or be deposited therein, such fees shall be payable as the Conservator of Forests, with the previous sanction of Government, shall, from time to time, notify.

17. The Conservator of Forests shall, from time to time, make known, by notification published in the *Bombay Government Gazette*, and locally, in such manner as he deems fit, the name and situation of every depôt in his division.

18. The person in charge of any vessel which carries timber or other forest produce on a river on the banks of which one or more of such depôts are situated, shall call and stop his vessel at each such depôt which he has to pass, in order that the timber or other forest produce may be examined, if necessary, under the provisions of Rule 14, and the person in charge of such vessel shall not proceed with such vessel past any such depôt without the permission of the Forest Officer in charge of such depôt.

19. No person shall close up or obstruct the channel or any portion of the bank of any river lawfully used for the transit of timber or other forest produce, or throw grass, brushwood, branches, or leaves into any such river, or do any other act which may cause such river to be closed or obstructed.

20. Any Forest Officer, not lower in rank than a Sub-Assistant Conservator of Forests, may take such measures as he shall, at any time, deem to be emergently necessary for the prevention, or removal of any obstruction of the channel, or of any part of a bank of a river lawfully used for the transit of timber, or other forest produce, but any such case which is not emergent shall be reported to the Collector, who may, by written notice, require the person whose act or negligence has caused, or is likely to cause the obstruction, to remove or take steps for preventing the same within a period to be named in such notice, and if such person fails to comply with such notice may himself cause such measures to be taken as he shall deem necessary.

The reasonable costs incurred by a Forest Officer or by the Collector under this rule, shall be payable to Government by the person whose act or negligence necessitated the same.

21. No person shall establish a saw-pit or convert, cut, burn, conceal or mark timber within one mile of the limits of any Reserved Forest (whether a Village Forest or not) or of any Protected Forest, without the previous written permission of a Forest Officer not lower in rank than a Sub-Assistant Conservator.

22. No timber of large scantling, which does not belong to Government, shall be moved from any district of the Presidency of Bombay, unless there is affixed thereto a distinguishable Private Property mark of the owner of such timber of a description which has been registered in the office of the Conservator of the Division, nor (if the said Conservator shall so direct) unless there has been made thereupon a Government transit mark of such description as shall from time to time be prescribed in this behalf by the said Conservator.

23. The Conservator of Forests shall upon receipt of an application for registration of any form, mark, or name for the purposes of Rule 6, or Rule 22, inquire into the authenticity of the same, and if he sees no objection shall, on payment by the applicant of such fee, as shall from time to time be prescribed by Government, register such form, mark, or name in his office.

Every such registration shall be held good for a period of one year only.

24. No person other than a Forest Officer, whose duty it is to use such mark, shall use any property-mark for timber which is identical

with, or nearly resembles any Government transit mark, or any mark with which timber belonging to Government is marked;

and no person shall, while any timber is in transit under a pass, issued under Rule 13, alter or efface any mark on the same.

25. Nothing in the foregoing Rules 2 to 24—both inclusive—shall be deemed to apply to the Province of Sind.

In that Province the special rules contained in Appendix B shall be applicable.

26. Any person who breaks any of the foregoing Rules 2 to 24—both inclusive—or any of the rules contained in Appendix B, shall be punished with imprisonment for a term which may extend to six months, or fine which may extend to five hundred rupees, or both.

27. Nothing in the foregoing Rules 2 to 26—both inclusive—shall be deemed to apply to the city of Bombay as defined in the Bombay General Clauses Act 1866.

APPENDIX A. (see RULE 2).

APPENDIX B. (see RULE 25).

Special Rules under Section 41 of the Act for the Province of Sind.

1. All words used in these rules and defined in Act VII. of 1878, (The Indian Forest Act) shall be deemed to have the meaning respectively attributed to them by the said Act.

2. No timber or charcoal shall be brought within the municipal limits of the cities of Shikarpur, Sukkur, Rohri and Hyderabad, except by the roads and landing places below mentioned (namely):—

<i>Roads.</i>	<i>Landing-places.</i>
Shikarpur, A'bad, Melani and Ruk road.	On the Sind Canal at Lakhi Tor.
Sukkur, A'bad, Melani, and Shikarpur roads.	Sukkur Bandar.
Rohri—Multan road ...	Rohri Bandar.
Hyderabad—road over old Phuleli Bridge, road over new Phuleli Bridge, Hajipur road, Gidu Bandar road.	Gidu Bandar, and near Bridge, over the new Phuleli.

3. No person shall remove any timber or charcoal from any Reserved or Protected Forest without a pass signed by the Forest Officer in charge of such Forest, or otherwise than in accordance with the conditions of such pass.

Every such pass shall specify—

(1) the quantity and description of the timber or charcoal which it covers,

(2) the name of the person removing such timber or charcoal,

(3) the name of the Forest from which it is removed, and

(4) its destination.

4. No person who wishes to remove any timber sufficient to make a cart or camel-load from any land which is not included in a Reserved or Protected Forest, shall remove the same from or to any place within twenty miles from a Reserved or Protected Forest, without obtaining from the holder or manager of the land, or if such land be Government waste-land, from the Tapedar of the tapa, a written certificate setting forth the quantity and description of the timber to be removed and the date of its removal.

5. No person shall bring firewood or charcoal, the produce of any land not included in a Reserved or Protected Forest, for sale into the cities of Shikarpur, Sukkur, Rohri or Hyderabad without a pass signed by a Forest Inspector, or a Tapedar, and setting forth the quantity and description of the firewood or charcoal covered thereby.

6. Every person in charge of any timber or charcoal to which any of the last three rules is applicable, shall retain the pass or certificate relating to such timber or charcoal in his possession, so long as the same is in transit, and shall, on demand, produce the pass or certificate for inspection by any Forest or Police Officer, and if such timber or charcoal is being conveyed into the city of Shikapur, Sukkur, Rohri, or Hyderabad, shall produce the pass or certificate at the stations, called "Guards" established on the routes leading to those cities for examination.

No. 4168.—*The 11th August 1880.*—*Mr. R. C. Wroughton*, Assistant Conservator of Forests, Násik, is allowed privilege leave of absence for three months from 7th September next.

No. 4286.—*Bombay Castle, 16th August 1880.*—His Excellency the Right Honorable the Governor in Council is pleased to extend the Indian Forest Act, VII. of 1878, to the undermentioned thirteen villages of the Bávda State, situated in the Ratnágiri District, and to appoint the Forest Officer of Kolápur to exercise within those villages the powers referred to in sections 20, 24, 25, 33, 45, 46, 50, 52, 55, 56, 60, 63, 67, 71 and 82 of the said Act :—

1 Kajirda.	6 Math.	11 Falavda.
2 Hatada.	7 Karaka.	12 Javadetha.
3 Walavda.	8 Kolamba.	13 Tulsavda.
4 Milanda.	9 Mur	
5 Tamhava.	10 Savdan.	

The 30th August 1880.—*Mr. S. Hornidge*, Sub-Assistant Conservator of Forests, and *Mr. G. A. Hight*, Assistant Conservator of Forests, respectively delivered over and received charge of the Ahmednagar District Forest Office on the 23rd August 1880, before office hours.

No. 4661.—*The 4th September 1880.*—Government are pleased to appoint *Mr. S. Hornidge*, Sub-Assistant Conservator of Forests, to act as Assistant Conservator of Forests, Surat, during the absence of *Mr. T. B. Fry*, and *Mr. J. C. Stobie* to act as Sub-Assistant Conservator during the same period.

The 9th September 1880.—*Messrs. R. C. Wroughton* and *T. B. Fry*, Assistant Conservators of Forests, respectively delivered over and received charge of the Násik District Forest Office on the 6th September 1880, after office hours.

Mr. S. Hornidge, Sub-Assistant Conservator of Forests, returned from Ahmednagar and reported himself for duty to the District Forest Officer, Poona, on the 25th August 1880, before office hours.

The 11th September 1880.—*Messrs. A. D. Younghusband* and *J. L. Jenkins*, Assistant Collectors, respectively delivered over and received charge of the Surat District

Forest Office on the 7th September 1880, after office hours.

Messrs. T. B. Fry, Assistant Conservator of Forests, and *A. D. Younghusband*, Assistant Collector, respectively delivered over and received charge of the Surat District Forest Office on the 3rd September 1880, after office hours.

No. 5142.—*The 24th September 1880.*—His Excellency the Right Honorable the Governor in Council is pleased to sanction the following addition to Rule 8 of the Rules for the examination of Forest Officers prescribed in Government Notification, No. 2878, dated 4th June 1880 :—

“ But an officer who in consequence of transfers has passed in the vernacular languages of two different Districts by the Lower Standard, will, if otherwise qualified, be eligible for promotion to the 1st Grade of Assistant Conservator, in whatever District he may be serving, without being required to pass in any one language by the Higher Standard.”

Messrs. J. L. Jenkins, Assistant Collector, and *S. Hornidge*, Acting Assistant Conservator of Forests, 3rd Grade, respectively delivered over and received charge of the office of the Gujarát Forest Circle on the 20th September 1880, before office hours.

No. 5046.—*The 24th September 1880.*—*Mr. G. K. Betham*, Assistant Conservator of Forests, Khándesh, is allowed privilege leave of absence for one month from the 3rd October 1880, or such subsequent date before the 15th of that month as he may avail himself of it.

No. 5109.—*The 28th September 1880.*—*Mr. Govind Ramchandra Mahajan*, Sub-Assistant Conservator of Forests, acted as Assistant Conservator, 3rd Grade, Sátára, from 15th April to 11th July 1880, during the absence of *Mr. Mainwaring* on privilege leave.

Mr. S. Hornidge, Sub-Assistant Conservator of Forests, acted as Assistant Conservator, 3rd Grade, Ahmednagar, from 23rd July to 22nd August 1880, during the absence of *Mr. Hight* on privilege leave.

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[No. 2.

The Indian Monsoon Rains.*

It is a truth so abundantly illustrated by the famines of recent years as to amount almost to a truism, that in the state of assured peace conferred by the British rule, the well-being and prosperity of the people of India depend, above all things, on the sufficiency and seasonableness of the rainfall.

In a country which derives its wealth almost exclusively from agriculture, this must always be the case; for, however much we may succeed in mitigating the disastrous effects of a season of drought by extending irrigation, and may equalize the incidence of scarcity by improving transport and facilitating trade, we can at best but mitigate the disaster and suffering: we can neither control the cause nor more than partially avert the loss.

But although we can no more control the weather than we can still the earthquake or extinguish the volcano, it may still be possible in some measure to foresee, and foreseeing, to prepare to meet whatever vicissitudes may be in store for us. Capricious and lawless as seem the changes of our weather, and the irregularities of our seasons, no physicist doubts that they are as rigorously conformable to law as are the rising and setting of the sun, or the ebb and flow of the tides; and such being the case, a knowledge of the chain of processes by which they are brought about is, as far as we can see, only a question of time and patient inquiry.

In India, the prosecution of this inquiry is attended with fewer difficulties than fall to the lot of most of those who engage in similar inquiries in Europe. In the first place, the action of the sun is more direct, and it is in that action that all weather changes have their origin; and in the second place, the mountain girdle of India shuts us off, in a very great measure, from the influences of the continent to the north of us, so that we need not, in general, concern ourselves with changes that may be in progress in these comparatively

* A Lecture delivered at the United Service Institute, Simla, on the 22nd September, by H. F. Blanford, F.R.S.

inaccessible regions. Most of our weather changes are the result of processes in operation either on the plains of India, on the surrounding mountain slopes, or on the seas which lie between us and the Equator. It is owing to these advantages that, during the few years that systematic observation has been carried on in India, we have been able to learn so much as we already know respecting the meteorology of India,—much more, I think, than we could have acquired, in an equal space of time, in perhaps any other part of the world. I shall endeavour to give you, in a condensed form, some of the more striking results, thus arrived at, with respect to the rainfall of the Indian monsoons.

In most countries, there is some one season of the year at which rain is more frequent and abundant than at others. Even in England, where, according to our familiar experience, the rain it raineth every day, there is a very decided preponderance of rain in the winter. In Central Europe, on the other hand, the summer is the season of the most abundant fall; and as Dr. Hann has lately shown, on the east coast of the Adriatic, most rain falls in November. In the tropical zone, the rainfall season is more distinctly marked, and it occurs shortly after the sun attains its greatest altitude; so that, on and near the Equator, there are, as a rule, two seasons of maximum rainfall; and in the neighbourhood of the tropical circles, the chief rain falls in the later summer months. In India, the rainy season is as distinctly marked as anywhere in the tropics; and owing to its geographical position, *viz.*, to its forming the southern extremity of a continent which reaches far into the tropical zone, the periodical rainfall extends far to the north of the Tropic of Cancer, with all its characteristic tropical features.

But although the summer monsoon rains fall more or less in all parts of India, and, in most parts, are the principal rains of the year, variations occur in different parts of the country, which are of much importance in their influence on the local agriculture; and it is only in some parts of Western India that the rainfall of other seasons is too uncertain to be regarded as a normal feature of the climate. In the greater part of extra-tropical India, the rains of the later winter months, although much less copious, are scarcely less important to agriculture than those of the summer monsoon; and more especially so in the Punjab and the upper part of the North-Western Provinces. The cause of these rains is hardly so well understood as that of the summer rains, and I shall not have to deal with them in this lecture. It will, therefore, be sufficient to observe here that they are brought from the sea by temporary winds, which, in the Gangetic Valley at least, have much the same direction as the summer monsoon, but which have neither the same volume nor the same distant

origin. In Assam and Bengal, and, to a certain extent, in the lower part of the North-Western Provinces, and in the Central Provinces to the east of Nagpore, as well as in the peninsula further south, a certain amount of rain falls also in the spring months; in the greater part of India proper, this falls chiefly in little local storms, sometimes as hail; but in Eastern Bengal and Assam it is more abundant and continuous. It begins in the latter part of March, and becomes more frequent and copious in the subsequent months, so that it eventually assumes the character of the monsoon rains, and it may be said that, in these provinces, the monsoon rains set in six weeks or two months earlier than in the more western provinces. Lastly, in the Carnatic, the principal rainfall occurs at the close of the summer monsoon. While the rains of this monsoon are falling heavily in Northern India, and on the west coast of the peninsula, the plains of the Carnatic receive but a few occasional showers; and it is not until October, when the rains are over in Upper India, and have almost ceased in Bengal, that the monsoon wind of the Bay of Bengal recurves, and blowing as an east and north-east wind on the coast of Madras, brings to that part of the peninsula the heaviest rain of the year. All these variations are dependent on the local geographical conditions, and of most of them we are enabled to give a fair account, tracing them to those variations in the course of the winds, which follow from recognized physical laws.

If the rain which, on an average, falls annually in India, were equally distributed over the whole country, it would form a sheet of water about 35 inches in thickness—a fact which we express by saying that the average rainfall of India is about 35 inches.* In point of fact, however, instead of being equally distributed over the country, the rainfall of India is characterized by inequalities greater than those of any country in the world. On the one hand, we have Cherrapunji, long renowned as the wettest known place in the world, with an annual fall which, in some parts of the station, amounts to 600 inches; and, on the other, we have such stations as Jacobabad and Sehwan, where the average does not exceed four or five inches, and sometimes, as occurred last year at Sehwan, the total rainfall of the year amounts to less than one inch.

The rainfall chart on the wall exhibits the more striking features of this unequal distribution, the average copiousness of the rainfall being shown by different depths of tint. Two narrow bands of the deepest tint, the one running up the west coast of the peninsula as far as the mouth of the Tapti, the other skirting in like manner the coasts of Burmah and Arakan, then broadening out in Bengal and Assam, and

* Omitting Lower Bengal and Assam.

again contracting to a narrow band which skirts the southern slopes of the Himalayas, indicate those regions in which the average amount of rainfall is over 75 inches. The greater part of the chart, including nearly all that lies to the east of the meridian of Cape Comorin, is covered with a somewhat lighter tint, indicating an average fall between 30 and 75 inches. Two tracts of a still lighter tint occupy, respectively, the western half of the Deccan and the Mysore plateau, and a zone of country extending from Guzerat up the Aravallis through Eastern Rajputana and the Gangetic Doab to the Punjab. In these, the rainfall varies from 15 to 30 inches. Finally, Western Rajputana, Sind, Kutch, and the Lower Punjab, are left untinted, indicating that their average rainfall is less than 15 inches in the year. The chart illustrates the distribution of the total rainfall of the year; but that which falls during the summer monsoon so greatly preponderates over that of other seasons, that a chart of the summer rainfall would differ from that before you only in unimportant details; with the exception, indeed, of the Carnatic region.

The natural processes which result in the formation of rain are essentially the same as are concerned in the process of distillation. The fire, which serves to evaporate the fluid, is represented by the sun; the boiler by the sea, and in a minor degree by every wet or even slightly damp surface exposed to the sun's rays, or to winds that have been warmed by the sun; the current of vapour down the neck of the still is represented by the wind which carries the newly-formed vapour to the seat of the rainfall; in the case before us, by the summer monsoon wind; and finally, the worm and cooler, in which the vapour is condensed, are represented by the cloud from which the rain precipitates. Only in this last element is the parallel less strict than elsewhere; for, as we shall presently see, the cooling and condensing agency, in the case of rain-formation, is inherent to the cooling mass; not external to it, as in the case of the still. I must now describe each step of the process a little more in detail.

First, then, as regards our fire—the sun. Let us see what work it actually does in the way of evaporation. From a measurement of the sun's heat on a clear day, made by Sir John Herschell at the Cape of Good Hope, it may easily be computed that, shining vertically overhead through a clear atmosphere, the heat, if totally absorbed and used up in evaporating water at a temperature of 80° , would evaporate a sheet one inch thick in about 16 hours 25 minutes. Hence, during a day of 12 hours, with the sun in the zenith at noon, making due allowance for the varying thickness of the atmosphere traversed by its rays, the evaporation would amount to about one-third of an inch. But this supposes all the heat to be used up in the work of evaporation; whereas, in fact,

a certain portion is absorbed in raising the temperature of the sea surface, and another portion is not absorbed at all, but is thrown off by reflection; as may, indeed, be felt very sensibly by any one who sits on the deck of a steamer, in the full glare of the sun's reflection from a smooth sea-surface. What may be the amount actually evaporated is not very accurately known. From the observations of Mr. Binnie, on the evaporation of the Ambajhari tank at Nagpore, and those of Mr. Culcheth on that of a tank at Beawar in Rajputana, it appears that the loss of water, by evaporation, amounts to about one-fifth of an inch per day in the dry climate of those regions. At the Vehar tank at Bombay, Mr. Conybeare found the evaporation to be less than this, *viz.*, one-eighth of an inch; and it is probable, therefore, that on the open sea it does not exceed one-tenth of an inch daily.

At this rate, we should have about three feet of water evaporated annually from a tropical sea; capable, therefore, when precipitated as rain, of yielding 36 inches of rainfall over the same surface. Now, the area of the Indian Ocean north of the Equator, including the Arabian Sea and Bay of Bengal, may be taken, in round figures, as four millions of square miles. But, during the summer monsoon, the winds, occasionally, at least, blow across the Equator, so that the evaporating surface over which the summer monsoon blows is probably not much less than double this estimate. The evaporating surface is, therefore, ample to furnish the rain that falls on India and Burmah; since but little falls on the dry countries lying to the west of India, and there is good reason to believe that the rainfall over the sea is relatively much smaller than on the land reached by the sea winds. But the land itself also furnishes vapour; and there can be little doubt that re-evaporation of the fallen rain, and the vapour given off by vegetation, furnish a supply which is not only appreciable, but is perhaps, at certain seasons, the chief source of the rainfall. From what has been observed by Dr. Brandis in Assam, it seems not improbable that the spring rains of the upper part of that valley are mainly dependent on the local evaporation of that damp, forest-clad province. Before following the further history of the vapour thus produced, let it be noted that, although its temperature is appreciably the same as that of the water which yields it, in the act of becoming vapour, it has locked up, so to speak, as much heat as would raise nearly six times its own weight of water from the freezing to the boiling point. What becomes of this heat, and what part it plays in the movement of the monsoon, we shall see in the sequel.

Before I endeavour to explain to you the cause of the summer monsoon, which brings the vapour furnished by the Indian Ocean, to precipitate it on the hills and lowlands of

India, I must premise a few words of explanation on the subject of that oft-mentioned and useful, but much-misunderstood instrument—the barometer. The popular conception of the barometer as a weather-glass has been deeply implanted in our minds by the absurd and generally misleading words engraved on the old-fashioned dial-barometers, the form of the instrument, with which most of us became acquainted for the first time, in our early and more impressionable years. What the barometer really shows is simply the pressure of the air,—pressure, that is to say, such as is exerted by a spring or a weight, and which, invisible and impalpable as air is, is nevertheless, here at Simla, not much less than $14\frac{1}{2}$ hundredweights on every square foot of surface. At the level of the sea, or at Calcutta, for instance, it is about two-sevenths greater than this, or nearly 18 hundredweights, or $\frac{2}{7}$ of a ton on the square foot. Whatever may be the local pressure of the air, this is shown in the barometer by the height of the mercury column in the barometer tube, which that pressure supports. All beyond this, as to the actual state or prospects of the weather, is inference, which may be sound or unsound, according to the amount of knowledge we bring to bear on the question.

Now, let us contemplate one or two facts which we learn from the barometer, and which have an important bearing on the subject before us. In the month of June, the average height of the barometer column here at Simla* is 23·17 inches; at Ludhiana, in the same month, it is 28·70 inches. As the first of these measurements expresses the pressure of the atmosphere at a height of 6,953 feet above the sea, and the second, the pressure at only 812 feet above the sea level, it is obvious that the difference, *viz.* 5·53 inches, expresses the pressure exercised by that layer of the atmosphere that lies between these elevations. In other words, this sheet of the atmosphere, 6,141 feet thick, weighs the same as a sheet of quicksilver 5·53 inches thick. This, however, is true only for June, and even for that month is an average, not a constant value.

In January, the average height of the barometer at Simla is 23·34 inches, and at Ludhiana 29·23 inches, and the difference of these figures, *viz.*, 5·89 inches in like manner, expresses the average weight of this same layer of the atmosphere in that month. From January to June, this layer of air has been gradually diminishing in weight, and has lost as much of its substance as would counterbalance a sheet of mercury rather more than $\frac{1}{2}$ of an inch in thickness. At the same time, since the barometer at Simla stands 0·17 inch lower in June than in January, the atmosphere above our level has also lost in weight, but not quite half as much absolutely

* At the Quarter-Master General's Office at Portmore.

as that which lies below us. It is this variation in the weight of the atmosphere over the land surface of India which, as we shall presently see, is the immediate cause of the change of the monsoons.

But there is yet another point of view from which we have to regard the indications of the barometer. Calcutta and Madras are both very nearly at the same level above the sea, yet the pressure of the air at these two stations, as indicated by the barometer, is, as a general rule, not the same at the two places. In January it is almost always greater at Calcutta than at Madras, in June greater at Madras than at Calcutta. Now, wherever two places at the same level show different air pressures, or, what is the same thing, show different barometric readings, the air tends to move from the place of the higher to that of the lower pressure, producing a wind. And accordingly, in January, the wind blows from Calcutta towards Madras; in June from Madras towards Calcutta. In the case of stations that are at different levels, for instance, Lahore and Calcutta, a direct comparison of the barometric readings will not tell us much; but it is very easy to compute from the actual readings at any moderate height (say up to 1,000 feet) what the reading would be at so many feet higher or lower; and thus, whatever the elevation of our stations may be, provided their difference is not greater than one or two thousand feet, we can reduce them to one common level at which we can compare them; and thus, if we have barometric readings from a sufficient number of stations, we learn what are the variations of pressure in a horizontal direction, or, as we may otherwise express it, what is the distribution of pressure on a given day, or on the average of a given month, over the whole surface of India.

In the two charts before you, this distribution of pressure is shown for the months of January and July. The blue lines, which are technically termed *isobars*, are in each case drawn through all places that have the same pressure (corrected, that is to say, to a common level, in the manner I have just described). Taking, first of all, the January chart: an *isobar* is drawn so as to include Sind and all the central portion of the desert of Bikanir. This line indicates a pressure (reduced to sea level) of 30.1 inches; and it surrounds a tract having a slightly higher pressure, on which stands the label "high barometer." The next line is supposed to pass through all places at which the pressure is 30.05 inches; the next again, through all places with a pressure of 30 inches. This runs a somewhat irregular course down the peninsula, from the Gulf of Cambay to the mouth of the Cauvery, and its course indicates that the pressure of the west coast of India, with a strip of the country above the Ghâts, Mysore, and the peninsula south of the Cauvery, is less than 30 inches. In this chart, then,

the highest pressure is in Sind and Western Rajputana, the lowest on the coast of Travancore and Ceylon; and the arrows on the chart show that, while the winds blow away from the former, they blow rather towards the latter, not directly indeed; but to this point I shall return presently.

In the July chart, an *isobar*, which represents a pressure of 29·45 inches, is drawn nearly round the Western Punjab, Bahawulpore, and Upper Sind; and the space thus included, (in which the pressure is less than that indicated by the *isobar*) is marked "low barometer," since it is, in fact, that part of India where the pressure at this season, on an average, is lower than elsewhere. The *isobars* on this chart are more numerous than on that of January, showing that greater differences of pressure exist; that with the highest value, *viz.*, 29·85 inches, just cuts off a little bit of Ceylon and the coast of Travancore. It is here that the pressure is highest (as far as is shown on the chart); and, accordingly, the winds indicated by the arrows blow away from this, and following a somewhat circuitous course, tend towards the Punjab and Upper Sind. Further south and west on the open sea, the pressure is still higher than on the coast of Travancore, and the south-west or *summer* monsoon (as I prefer to call it) blows from this tract of high pressure to the tract of lower pressure over India, and terminates at the seat of lowest pressure in the Punjab.

That the wind should blow from a place where the pressure is high, and towards one at which it is low, may be understood without much difficulty; but now we have to consider the question, "what causes these variations of pressure?"—a question which must be answered before we can be said to understand much about the monsoon, or the rain which it brings us. The sun shines with equal intensity on land and sea; but the temperature of the land and the wind that blows over is not the same as that of the sea. In the hot weather the sea-breeze is a cool breeze; in the cold weather the land wind is the cooler. In a well-shaded place on a steamer in these seas, and during calm weather, there is a difference of only 5° or 6° between night and day. But in the Punjab (which one may take as a good illustrative instance, because the climate is dry, and it lies far from the sea), this difference is often 30°, and sometimes as much as 40°, and even more. Now, these differences are partly due to the fact that the materials of which the land consists, earth and stone, are both heated and cooled much more readily than water. In fact water requires four or five times as much heat to raise its temperature, say 1°, as do stone and earth; and if, therefore, both are exposed to the same source of heat, the water requires four or five times as long to become heated as the materials that form the land; and the same to cool.

Further, a great part of the solar heat that falls on the sea surface is used up in evaporating it, but on the land very little of the heat is so utilized. It is absorbed by the ground and then stored up, whence by degrees it is given off again to the wind that sweeps the surface. So much is this the case, that I find that, on the average of two years, the temperature of the ground of Calcutta, at 3 feet deep, is not less than 5° higher than that of the air; and, in like manner, Mr. Broun found, at Trevandrum, an average difference of 5.7° between the ground temperature at 3 feet depth and the air.

There is yet a third reason why in the summer the heat of Northern India should become excessive. The quantity of solar heat received by any place depends both on the height of the sun and on the length of the day. In respect of altitude, the sun is, of course, hottest, when it shines directly overhead, and this is the case at places on the Tropic of Cancer on the 21st June. But since the days become longer in summer as we go further north, it results that, on the average of the summer, from the 1st May to the 15th August, more heat falls on the zone between 30° and 40° north latitude, than on any other part of the globe.

It is herein that we have the primary cause of the summer monsoon, and therefore of the rain. The Punjab is that part of India which, on the average of the summer, receives most of the sun's heat; and since it is a very dry region, and comparatively cloudless, this heat serves mainly to heat the ground and the air resting on it; and accordingly, as our temperature registers show, in the latter part of May and in June, the heat of the Punjab surpasses that of any other part of India.

Now, the effect of heat on the atmosphere is to expand it. The consequence is, that as the lower strata of air (which are those most heated by contact with the land) are gradually warmed up from January to June, they expand and lift all the super-incumbent higher strata of the atmosphere, somewhat as the expanding springs of a gigantic spring mattress might do. These higher strata, thus lifted, partly flow away towards some cooler region, chiefly towards the winter hemisphere; and the result is, that the pressure of the air over India, and especially over the Punjab, falls.

You will now understand why the stratum of air between the levels of Simla and Ludhiana weighs less in June than in January. It is much hotter, and, being expanded by heat, less dense. You will also understand why, at the sea level in June, the pressure of the air is less in Bengal than at Madras, and least in the Punjab. The pressure is least when the heat is greatest. The chart before you, which represents the distribution of temperature and, in part, of pressure on one of the hottest days in May 1879, serves to illustrate this.

I will now briefly recapitulate what we have just learned respecting the cause of the summer monsoon; *firstly*, during the spring and earlier summer months, the land of India becomes more rapidly heated than the sea, and very speedily acquires a higher temperature, which it retains till late in the year. This arises, partly from the fact that the materials of which the land consists are more rapidly heated than water, in the proportion of 4 or 5 to 1; partly because much of the heat that falls on the sea is used up in evaporating it, whereas very little is so consumed on the land. The Punjab is the seat of the highest temperature in India, partly because it is a very dry region, but principally because, on the average of the summer months, the zone of the earth in which it lies receives more sun's heat than any other; *secondly*, the seat of highest temperature becomes also the seat of lowest atmospheric pressure, or the region where the barometer shows the lowest reading. This is because the lower strata of the atmosphere, and more especially the lower 6,000 or 8,000 feet, expand as they are heated, lifting up the higher strata, which then partly flow away towards cooler regions; for precisely the same reason that if one end of a trough of water is lifted, a part of the water flows from the higher to the lower end; and, *thirdly*, the air at the sea surface moves from where the pressure is highest, that is, in the neighbourhood of the Equator, or rather to the south of it, to where the pressure is lowest, *viz.*, over India, and especially towards the Punjab. Such is the explanation of the second part of our subject, *viz.*, why the summer monsoon brings to India the vapour that has been produced in abundance over the seas which stretch away to the southward.

Before passing on to the next part of our subject, I must, however, draw your attention to one point, in which you may have observed that the evidence of the wind charts of January and July, which are before you, does not exactly accord with the description I have given. You will have noticed that the winds in January do not blow *directly* away from Western Rajputana or Sind, which is then the seat of highest pressure, nor in July do they blow *directly* towards the Punjab, which is then the seat of lowest pressure. On the contrary, their course is very circuitous. In January they rather blow spirally outwards, circulating in the same direction as the hands of the clock move; and in July they blow spirally inwards, the circulation being of the opposite character, or against the movement of the clock hands. Thus, in July, the winds on the west coast of India are nearly from west, not from south, and the same in the Central Provinces. And on the Bay of Bengal, they are from south-west, not from south-east, which would be the direct course towards the Punjab; while, in Lower Bengal, they are south, and only in the Gangetic Valley south-east or more easterly.

This circuitous course is, in both cases, the consequence of a law which an American mathematician, Mr. Ferrel, has shown to apply universally to all bodies moving on the surface of the earth, and which is now known as Ferrel's law. It is in consequence of the earth's revolution on its axis that rivers, railway trains, winds, indeed everything that moves over the earth's surface, tends to deviate to the right in the northern hemisphere; to the left in the southern hemisphere. A train moving at the rate of 50 miles an hour, say in latitude 30° north, presses against the right rail, with an accelerating force of $\frac{1}{8}$ th of an inch per second, when running on a perfectly straight part of the line. And this pressure varies directly as the rate of its movement, increasing with the latitude, so that, while it is zero at the Equator, it reaches its maximum at the pole, where it would be exactly double as great as in latitude 30° . It is probably partly in consequence of this law that rivers generally tend to hug the right side of their valleys. Thus, the Indus flows nearer to its mountain barrier than does the Ganges; that of the former being on the right, that of the latter on the left of its course. There are doubtless other and more powerful causes at work in these cases which are geological, and have nothing to do with the earth's rotation; but still this influence is not without its effect.

Now to return to the winds. You can easily see that, if a number of wind-currents are radiating in several directions outwards from a region of high pressure, and all tending to deviate to the right, the result will be a spiral circulation with the hands of the clock. And, on the other hand, a number of wind-currents, flowing radially inwards towards a place of low pressure, will move, not directly towards it, but to the right of it; and their movements combining will produce a spiral movement inwards of precisely the opposite character to the former. Thus, then, is explained the actual movement of the monsoon, such as it is shown to be on the chart before you.

Having now considered the production of the vapour which furnishes our rain, and the cause of the wind movements which bring it to us, it remains to notice the actions which condense it and precipitate it as rain. At a first glance, it seems not a little paradoxical that, having reached the hottest part of the earth's surface, it should there be condensed; seeing that, in order to condense it, it must be cooled, just as the steam produced in a still is cooled and condensed by being passed through the worm, which is surrounded by cold water. And this is really only a part of the paradox. For, in the act of condensation, the vapour must part with all that heat which, as I have told you, becomes locked up in it in the act of becoming vapour, and which would have sufficed to raise it nearly six times over from the temperature of ice to that of boiling water. Yet, not only is this heat got rid of, but it is precisely this which makes

the summer monsoon so much stronger and steadier than the opposite or winter monsoon. The solution of this paradox, which we owe mainly to the discoveries of Clausius, Joule, and Sir William Thomson, is perhaps one of the most beautiful applications of a physical law to the explanation of atmospheric phenomena which meteorology furnishes.

A few moments' consideration will convince us that the air, which the monsoon pours into India from both coasts, can only pass away by rising more or less vertically upwards, and flowing off in the higher strata of the atmosphere, which are beyond our field of observation. The mountain barrier on the north and west—and which in the former direction is so high as entirely to shut in the lower half of the atmosphere—prevents its escape in any horizontal direction. It *must* rise, therefore, some 8,000 or 10,000 feet, in order to escape to the westward, and not less than 18,000 or 20,000 feet to escape to the north. And if we suppose that it flows back again to the south as an upper current above the monsoon, we have reason to believe, from certain barometric observations on the mountains of Ceylon and on the Himalaya, that the monsoon current is not less than 10,000 or 12,000 feet thick, so that in any case there is no outlet for the air at any lower elevation.

Now, as air ascends, the pressure of the atmospheric strata above it is constantly diminishing. We know that, while the barometer at Ludhiana in June shows an average pressure of 28·7 inches, at the height of Simla it shows a pressure of only 23·17 inches. In rising, therefore, from the lower to the higher level, it comes under a pressure between one-fifth and one-sixth less than it was subject to originally; and just as a spring extends when relieved of the pressure, which keeps it down, so air expands under these circumstances. But while expanding it has to make room, so to speak, for the increase of volume, and therefore it must raise or thrust aside the air which presses upon it. In order to do this work, it draws on its own store of heat. If it is dry air, it can only draw upon that heat which gives its warmth. In other words, it cools; and from Joule's very accurate experiments we know that it must cool on one degree Fahrenheit for every 186 feet of rise. If, however, like the summer monsoon wind, it is charged with vapour, it cools at this rate only until it has reached the temperature at which it begins to condense its vapour and form cloud; and it then draws partly upon its own warmth; but still more upon that heat which was locked up in the vapour, and which I have more than once referred to. A cloudy atmosphere, in ascending, cools, therefore, more slowly than a clear atmosphere; in this case the rate varies with the temperature and the pressure; but we may take it, in the case of our monsoon, at one degree for 400 or 500 feet.

The flat-bottomed masses of clouds, with rounded piled-up summits, which are so common in the daytime over the plains of India, more especially in Bengal or in the Upper Provinces, when a light, damp wind from the eastward is bringing vapour from the direction of the sea, are an illustration of this action. The lower atmosphere is then rising, not *en masse*, but partially and locally, chiefly below the cloud. The flat base marks the level at which the air is first cooled to that point where the vapour begins to condense; and, as we know from the observations of Welsh and Glaisher, in their balloon ascents, the temperature decreases upwards, more slowly in a cloud than in the clear, cloudless atmosphere below it.

Again, in these hills, when a strong damp wind is blowing up either from the Sutlej Valley on the north-west, or from the Giri and its tributary, the Ussan, on the south-east, you may often see that, above a certain level, the air on the windward side of the ridge is thick with cloud. If seen from a distance, the cloud appears to be motionless. But near at hand, you may watch it carried up with the air current over the ridge, while new cloud is constantly formed at its base; and if, as sometimes happens, it is sinking on the side of the ridge, below a certain level, the cloud dissolves away. Such illustrations of the formation of cloud by ascending air and its absorption by descending air, are common in the hills.

In all cases, heavy rain indicates that the air from which it is precipitated is ascending. Generally below the cloud the air is calm; or, at all events, the wind is light: but air around must be pouring in to feed the rain; and thus we find that, between the region of heavy rainfall and the sea, a strong wind is blowing so long as the rain continues.

We may now turn our attention once more to the rainfall chart of India, which I described briefly at the beginning of this lecture. I then pointed out to you some of the more striking features of the rainfall distribution as shown on the chart, but left their explanation unattempted. With the knowledge which we now have of the physical actions which determine the formation of rain, we may contemplate these features with a more intelligent eye, and we can see how they result from the well-known geographical peculiarities of the country, in conjunction with the course of the winds. Here, for instance, on the west coast of the peninsula, is a zone of copious rainfall, bounded by the Western Ghâts; on some parts of which, as at Mahableshwar and Matheran, the annual average is not less than 250 inches. Within a few miles of the crest to the eastward of the Ghâts, the rainfall rapidly diminishes, so that, at Poona, it is only 31 inches, and the Deccan plateau, which stretches away to Sholapore and beyond, has an average of considerably less than 30 inches.

The wind from the Arabian Sea blows on the west coast from almost due west. Within 50 or 60 miles of the coast line, or even less, it meets the mural face of the Ghâts, to cross which the air must ascend at least 2,000 feet; and at some points, such as Mahableshwar and Baura fort, considerably more. Here then is the heaviest rainfall. But the ascent is not restricted to the face of the Ghâts. More or less, it is taking place over the whole breadth of the Konkan and Malabar, and hence the rainfall of all this strip of country is excessive. But having crossed the crest of the Ghâts, and having thus parted with a large proportion of its vapour, the wind descends, following the slight slope of the country. The geographical form of the country is, therefore, unfavourable for precipitation, and the rainfall is much below the general average of the peninsula. As we approach the opposite coast, we meet with the hilly country, which includes some plateaux of considerable height; and here again, the rainfall is higher, and some is also received from winds which, both in the spring months, and also at the close of the summer monsoon, blow from the Bay of Bengal.

The Arakan coast borders the foot of a mountain range higher than that of the Western Ghâts, and here again, therefore, we meet with a copious rainfall—that of Sadoway, for instance, exceeding 200 inches, while that of Akyab is but slightly less. But the wettest region of all is the south face of the Khasi Hills, which rise precipitously from the low inundated swamps of Sylhet. Cherrapunji, on the crest of this escarpment, has a rainfall which may be said to average more than 500 inches; while some registers, kept in earlier years, nearer the edge of the scarp than is the present rain-gauge station, showed an average of 600 inches. The position of this station is eminently favourable to the precipitation of rain. Up to the very face of the escarpment, the winds from the Bay sweep over an inundated country, and arrive saturated with vapour. The little sand-stone plateau, on which the station stands, forms a sort of peninsula, communicating by a narrow neck with the mass of the hills to the north, being enclosed between two gorges which debouch on the plains, and are terminated at their upper extremities by precipices of 2,000 feet sheer drop, over which fall the cataracts of Mawsmal. Blowing up these gorges, the air ascends vertically over the margin of the plateau; and being thus surrounded by vertically ascending currents, the deluge which pours down on the station is such as, as far as we know, is unparalleled elsewhere.

Time does not allow me to enter into an explanation of the variations exhibited by most other parts of Northern India; but I cannot quit this part of the subject without a few words in explanation of the dry desert tract which

borders the Indus, including Sind, Bahawulpore, and Western Rajputana.

The monsoon wind in Sind blows mainly from the south-west or south, following the line of the Indus. But the fact that, on the Arabian Sea, the winds are rather west than southwest, leads us to infer that this wind does not come direct from the sea, but is largely recruited with air from the dry Gwadir coast; and indeed, were the mountain ranges which bound the Indus Valley on the west effaced, the law of the winds indicates that it would be entirely derived from Beluchistan. It contains little vapour, and, accordingly, rain falls in Sind and on the hills chiefly, when the wind blows from the east; and this occurs but rarely. It is then the geographical position of Sind, having an exceedingly dry country to the westward, together with the fact that the seat of lowest pressure usually lies to the north of it, in the Punjab, that renders Sind comparatively rainless.

Before I conclude, you might expect that I should say a few words on the irregularities of the monsoon rains, those seasons of drought or of local drought and local flood, of which we have had so many disastrous examples during the last few years. I should be, indeed, only too rejoiced could I give you as satisfactory an account of the causes of these irregularities as I have endeavoured to give you of the normal features of the monsoon rains. But the five or six years, during which we have been able to watch and take note of these vicissitudes of our seasons, are far from sufficient to do more than suggest points for future inquiry; and anything that I can say upon this subject will be of a very fragmentary, and, I fear, unsatisfactory character.

It is obvious that many different causes might be imagined to cause a diminished rainfall. For instance, diminished evaporation, arising from a deficiency of solar heat, or a decrease in the volume of the vapour-bearing monsoon, such as might ensue from a large part of the air from the sea being drawn in some other direction, or, instead of being drawn away towards the land, remaining comparatively motionless and condensing its vapour over or near the place of its production; or, one might imagine that, owing to some derangement in that series of processes by which the distribution of pressure is usually determined, that distribution might be so modified that less air should be drawn from the sea and more from the dry land region. It is quite possible that one or all of these suppositious causes may play their part, and indeed there is little doubt that, to some extent, they do so. Thus, in 1876, the year of the great Madras and Deccan famine, there was an unusual northerly tendency in the winds all down the peninsula; and during the present year, the Bombay monsoon has been usually deficient in vapour, whether owing to the

restriction of the area of evaporation or other cause. But although even such partial explanations are not without interest, they are at least but a first step, and a very small one, towards such an explanation as may enable us, to some extent, to foresee calamities arising from drought and flood; and their chief value is, that as far as they go, they represent an observed association of facts, the meaning of which our knowledge of physics enables us to appreciate, and they may therefore serve as stepping-stones towards some wider generalization. Of a very different category is the hypothesis, which has been so frequently brought forward of late years, that the rainfall varies with the spottiness of the sun's surface. This phenomenon is now known to go through a regular cycle of variation or, more probably, more than one periodical cycle, but certainly through one, the duration of which is about 11 years. Now, as regards the average rainfall of the world as a whole, I think that the very extensive mass of evidence collected and discussed by Mr. Meldrum, of the Mauritius, does show very good *prima facie* reason for the truth of the view which he originated, and has most conscientiously worked out. Taking the average from year to year of a great number of stations in America, Europe, Asia, Africa, Australia and some islands, it does appear probable, that the rainfall, about the time when the sun is most spotted, is about fifteen per cent. greater than when it is least spotted. But when we restrict our view to a single country, or group of stations, it is difficult to detect anything like a distinct cyclical variation amid the much greater variations that follow no such law. It is true that, from 1863 to 1876, the rainfall of the Carnatic did seem to conform to something like a regularly progressive cycle of variation, not differing very greatly from that of the sun spots. From 1863 to 1868 the rainfall of this province was below the average, and most so in 1867, in which year also the sun spots reached their minimum. From 1869 to 1874 it was above the average, with a maximum in 1872, or about $1\frac{1}{2}$ years after the sun spot maximum; and it was again below it in 1875 and 1876; very greatly so in the latter year. So far then, the accordance, although not exact, was sufficiently striking; since in 1876 the sun spots were rapidly approaching their minimum. But the sun spots were decreasing till the early part of 1879, whereas the Carnatic rainfall of both 1877 and 1878 (more especially the first of these years) was considerably above the average. The Carnatic is the only province of India in which I have been able to trace anything like this cyclical variation; and even here it is evident, that if the accordance be more than a mere fortuitous coincidence, it is too uncertain to be made the basis of a forecast.

As to the nature of the supposed connection between the state of the sun's surface and the rainfall of the earth, we must

admit that we know nothing. Even the fundamental point, whether the sun is hottest when most or when least spotted, is one on which you will find those, who have paid some attention to the subject, to hold the most opposite opinions. Such observations as have been made directly on the intensity of the heat emitted from the sun, seem to show that the sun is hottest when most covered with spots; but on the other hand, when this is the case, it appears that the temperature of our atmosphere is lowest, and that it is highest about the time that the sun has fewest spots. Until some way of reconciling these apparently conflicting observations has been found, it is obviously premature to form any judgment on the question of the relation of the rainfall to the solar variation. If Mr. Meldrum's view be accepted, that the rainfall varies directly as the quantity of the sun spots, it would accord with the result of the direct observations on the heating power of the sun; because we might expect that the hotter the sun the greater would be the evaporation from the sea surface, and the greater therefore the rainfall; but this question, like many others, must await further experience.

There is one class of facts which may perhaps be of some utility in enabling us to some extent to frame forecasts of our seasons in India, to which I may briefly refer, although their connection with the monsoon rainfall is little more than a tentative hypothesis. On many occasions it has been noticed that, when the winter or early spring rains have been unusually copious, and especially when they have been late, and have been accompanied with an unusual fall of snow on the Himalaya, the rains of the Upper Provinces and Rajputana have been either very deficient or much retarded. The first occasion on which I noticed this, was in the famine year 1876, which was preceded by abundant and late spring rains on the Upper Provinces with an unusual amount of snow on the mountains of Kashmir. A still heavier fall of snow on the Himalaya characterized the winter and spring of 1876-77; and, as will be remembered by many of you, the monsoon rains failed almost completely in the North-Western Provinces in that year. In the spring of 1878, the spring rains began late, *viz.*, in April, and lasted through the greater part of May, and much snow fell on the higher ranges. In this year the rains were only retarded, but they did not set in till the beginning of July, and were deficient in the Upper Provinces even in that month, and it was not until August that rain fell abundantly in North-Western India. Last year, 1878-79, both the winter and spring rains were remarkably deficient, while the monsoon rainfall was abundant. In the present year, both the winter and monsoon rains have been deficient, although there was good deal of cloud and rain in April and May, but the meteorology of the present year has yet to be

worked out. It is, however, a noteworthy fact that in July, as I was informed by Major Biddulph, the rain and snow on the mountains of Northern Kashmir were very unusual, and such as are unprecedented during the four years over which Major Biddulph's experience extends; and it will be within the recollection of all, that the month of August has been almost rainless in the Punjab, the North-Western Provinces, and Rajputana. Although then it would be perhaps unreasonable to look to this snow precipitation as the sole, or even perhaps the principal, cause of the failure of the monsoon rains in North-Western India, there seems good *prima facie* reason to regard it as an influential cause.

Seeing for how few years we have been able to investigate the meteorology of India with anything like system, I think that these glimpses of light, few and feeble as they are, are fraught with promise for the future, and I look forward with confidence to a time, when some successor of mine shall be able to give you as fair an account of the causes that disturb and interfere with the regular and beneficial course of our seasons, as I have endeavoured to give you this afternoon of the ordinary normal production of our rainfall.

Iron-making in India.

(From the "*Englishman*" of July 14th, 16th, and 17th, 1880.)

Now that the Afghan war is drawing to an end, it may be expected that the material progress of India will again engage the attention of the Indian Government. As a means of famine prevention, the development of industrial enterprises is to be ranked with, if it should not take precedence of, irrigation works and railways; and among such enterprises none, perhaps, holds out fairer prospects than that which has contributed so largely to British prosperity—iron manufacture.

Everybody knows that there is iron ore in many parts of India, but it is not generally known that in Central India there are ores of that metal of the best quality.

The Central India iron ores are remarkable at once for their purity and their richness. They are chiefly red iron ores and magnetite, containing sometimes manganese, but there are also brown iron ores and siliceous hematite. As all these ores occur in enormous quantities on the surface of the ground, the erection of costly mining works, which is elsewhere necessary, is here not required. Owing to the difficult treatment required for the magnetites, the native iron makers prefer the soft red ironstones of a laminated texture, although the former contain a larger percentage of iron. The brown iron ores and the siliceous hematites are used by them only very exceptionally.

Before showing how the Indian iron ores may be utilised without prejudice to English interests, we will give an analysis of the iron ores of Central India, together with some other details.

The magnetites contain 71 per cent. of metallic iron (or 69 per cent. oxyde, and 29½ per cent. protoxyde of iron), the red iron ore from 65 per cent. to 69 per cent. of iron (or 94 to 98 per cent. of oxyde of iron), the brown iron ore 45 to 55 per cent., and the siliceous hematites 40 to 48 per cent. of metallic iron. The few impurities of these ores are small quantities of quartz, clay, and manganese, and exceptionally some lime; of sulphur there are but few traces; of phosphorus none:—at least none have been discovered in the red iron ores and in the magnetites.

So much has the exceptional purity of these ores struck observers that somebody, writing of them in a public paper some time ago, maintained that they were pure iron, which is incorrect; the richest iron ores can never contain more than 72 per cent. of metallic iron. Iron always occurs in nature combined with oxygen, the lowest degree of oxydation being in magnetite. Pure iron might perhaps be said to occur in meteors, but here also it is combined with nickel from 3 to 8 per cent. We know of no ores in the world which are fully equal to those of Central India in purity, in richness, and quantity over a given area. The red iron ores of Whitehaven in Cumberland, the specular iron ores of Elba, the magnetites of Danemora in Sweden, and of Blodogat in the Ural mountains, are precious indeed, but they are found in smaller quantities, and have generally to be quarried from great depths, often many hundred feet, by means of expensive mining establishments, whilst here, by simple surface digging, we may say that immeasurable quantities of the stuff are to be obtained.

In general the European iron ores contain only from 30 to 35 per cent. of metallic iron, therefore half only that contained in the red iron ores and in the magnetites of Central India. How great a value is put on pure and rich ores by iron makers may be learned from the circumstance (which should be made widely known in India) that vast quantities of such ores are yearly imported into England, France, Germany, and Belgium from the south of Europe and more distant countries. In 1878 Bilbao, in Spain, shipped 1½ million tons of iron ores to Cardiff. Herr Krupp, the great gun-maker of Germany, has his own iron mines in Bilbao; France draws yearly 500,000 tons of iron ore from Mokta in Algeria, and England also imports large quantities from the same source. The exported ores of Bilbao are brown iron ores with 52 to 55 per cent. of metallic iron; those of Algeria are magnetite and red iron ore with 60 per cent. of metallic iron; the Bilbao and Algerian ores are therefore from 10 to 15 per cent. inferior to the same kinds in Central India.

The iron ores of Central India containing, as was said before, no phosphorus and little manganese, are suitable for the production not only of bar iron, but notably also of steel, and especially of Bessemer cast-steel for rails.

It is well known that the amount of phosphorus in the ore determines its fitness for the Bessemer process; and if it exceeds $\frac{1}{4}$ per cent. the steel cannot be converted into rails, which are now generally made of Bessemer steel.

Again, ores containing manganese are known to be especially useful for the production of steel for cutting tools. Equally suitable are the pure red iron ores of Central India, containing manganese, for the production of "Spiegeleisen" (specular cast iron) a kind of pig iron, which he added to the iron in the Bessemer process, and in cast steel crucibles. Great quantities of this article are exported from Germany and Austria, and the price of it is 60 per cent. higher than that of ordinary pig iron. The same is the case with an article called in the trade *acier sauvage* (wild steel), also a kind of pig iron, containing a very small quantity of carbon. This is exported at high prices, from Styria in Austria to England, France, and Belgium, for the manufacture of ductible iron for wire. Now "Spiegeleisen" and *acier sauvage* can only be obtained from the purest iron ores, and of these there are inexhaustible mines in Central India. Here we have then a most valuable raw material for exportation which would not interfere with England's commercial policy as regards India, which has hitherto consisted in the principle of taking India's raw produce and returning it to her in the shape of manufactured goods.

Should the art of iron-making in the course of time be so far developed as to furnish us with an economical process of making finished iron or steel direct from the ore, that is to say, without the introduction of the blast furnace and fining process, then pure ores would greatly increase in value and become eventually a most important article of export from India.

The following explanation of the present system of iron-making will show the importance of the exertions which are now being made towards the obtaining of iron by a *direct* process.

The object of the blast furnace-process is, first to free the ore from oxygen, then to induce carbon into the article so obtained, and, finally, to melt this compound. The product of the blast furnace is thus iron with a greater or lesser percentage of carbon, called pig iron. The next, namely, the fining process, has for its object, on the contrary, the freeing of pig iron from carbon, or the production of a metal free, or nearly free, of carbon. To the uninitiated the question will at once present itself why these opposite processes are followed—why the reduced ore, *i.e.*, the ore freed from oxygen, is not melted down direct into iron in the blast furnace instead of first infusing it

with carbon, and then freeing it from the same by the expensive puddling or Bessemer process.

The reason is two-fold : first, because it is difficult to melt down pure carbonless iron. It would require a heat of $1,700^{\circ}$ centigrade, whilst pig iron, or iron containing carbon, melts with a heat of from $1,100^{\circ}$ to $1,400^{\circ}$ centigrade, and it is this excess of from 300 to 500 degrees of heat which is difficult and expensive to attain, both as regards fuel and fire-proof material for the furnaces. The second cause of the round-about process is the more or less impure state of iron ores, especially in respect of phosphorus and sulphur. Opportunity and time for departure must be given to these impurities, and this is done by the repeated melting and manipulating of the stuff in the so-called fining process.

From this short explanation the reader will easily perceive that, in the case of the magnetite and red iron ores, in which we have to deal with either very small or inappreciable quantities of impurities, the question of producing pure iron or steel by a *direct* process is reduced to one for the science of heat to solve. It is a question, in fact, of producing $1,700^{\circ}$ centigrades of heat economically. The solution of this question is approaching. The efforts of Siemens, Dupuis, and others in this direction, if they have not solved this problem, have at least paved the way to its solution. But it may be objected that the best iron ores and the largest quantities of them in Central India are of no avail, as there are no coals there ; the reply to this objection is, that there is ample wood available. But it may be again objected, as was indeed done a short time ago, by a writer in the columns of a daily contemporary, that making iron in India with charcoal has been tried and has failed. It is well known, however, that excellent iron has been made in India for centuries with charcoal. Those also who know anything of the iron trade know that vast quantities of iron are made in Sweden and Styria, both for home consumption and for export, with vegetable fuel. It cannot be that the price of charcoal in India is an obstacle, since it is about three times as high in Styria, for instance, as in India ; neither can the failure have been caused by the experience of charcoal making bad iron, for the reverse is well known to be the case. The true cause is not far to seek ; it can have been due to nothing else than to ignorance, or bad mechanical arrangements, or bad management, or dishonesty, and very likely to all these combined.

Having said so much on the question of producing iron from the ore by means of vegetable fuel in general, we propose another day to examine the question in detail, since it is on this question of vegetable fuel *versus* mineral coal that the future iron industry of India must be decided.

The chief advantage of wood and charcoal over mineral coal, as a fuel, consists in the greater purity of the former.

This circumstance alone is of incalculable value in iron-making. Mineral coal contains from 6 to 25 per cent. ashes and a greater or less quantity of sulphur, both, as stated before, injurious to the production of iron. Much ashes make the work unclean, fill the furnaces with slag, produce smoke and dirt, which are the bane of the workman and a nuisance to the neighbourhood of an ironwork. The sulphur ingredient of coal is burned into sulphurous acid which renders the iron brittle, not to mention that it makes the work highly unpleasant and unwholesome. Wood contains but from $\frac{1}{2}$ to $1\frac{1}{4}$ per cent. of ashes, and never any sulphur; iron, therefore, produced by wood and charcoal, not only escapes contamination but any impurities which may be in the ore are to a great extent expelled from it.

The price of iron made with vegetable fuel is, for the reason just explained, very much higher than that of iron made with mineral coal, indeed often two and three times higher. Charcoal iron from Danemora in Sweden has been known to fetch in Sheffield £14 per ton at the time when English iron (made with mineral coal) was selling in the same place at £6 per ton. In Germany charcoal pig iron fetches 170 shillings per ton, against 75 to 80 for mineral coal pig iron. The same relative prices prevail in other iron-manufacturing countries. How great a demand there is for good charcoal iron, may be inferred from the fact that 90,000 tons of it are yearly exported from Sweden, one-third of which is taken by England. That more of this material is not exported from Sweden is due to the fact that the production of it is purposely checked for fear of lowering prices.

The only apparently valid objection which can be urged against iron-making on a large scale with wood and charcoal is, that it might lead to the destruction of forests, the preservation of which is so important on national, economical and sanitary grounds. To this objection must be opposed facts apparently paradoxical, yet perfectly true, namely, that it is in those countries in which the iron industries are carried on with wood and charcoal, that the forests are in the most flourishing condition. Whoever has travelled in Sweden, in Styria, or in Carinthia, could not but have been struck with the great extent and the magnificent appearance of the forests. This pleasing sight is entirely due to the great development of iron industries in these countries, and to their being carried on by means of wood and charcoal.

Sweden has 250 blast furnaces, and the Austrian crown-lands of Styria and Carinthia have 60 blast furnaces worked with charcoal. The fact is that the great demand for vegetable fuel, having greatly enhanced the value of forests, has given rise to a most careful treatment of them, and to a highly scientific system of artificial forest culture.

Sweden has no mineral coal, and it may be said also comparatively little agriculture. She nevertheless enjoys great national prosperity, which she owes entirely to turning to good use her fine forests and her superior iron. Those who are unacquainted with the manufacture of charcoal in large quantities may think that there must be a great waste of valuable timber connected with it. This need not be so, as all the valuable parts of trees may be reserved as timber.

In Europe it is calculated that a forest of average condition and under systematic management will yield yearly 800 tons of wood per English square mile, and that the trees felled will be reproduced every fifty years. Now, the production of 12 tons of finished iron per day by means of wood and charcoal would require yearly about 40,000 tons of wood, or the yearly produce of 50 English square miles of forest. But not far from the localities where the best iron ores occur, there are also forests (situated on a plateau elevated about 1,200 feet above the level of the sea) covering 2,400 square miles. These forests may be counted upon to yield 15,000 tons of wood per square mile, or about 56 million of tons for the whole area, and would therefore suffice to feed an iron work producing daily 12 tons of finished iron during nine hundred years, in which calculation the question of recouplement by natural growth and artificial planting has not been taken into account. If natural growth and artificial planting be taken into account, these forests can feed 40 blast furnaces for an indefinite period without being exterminated.

Besides the above forests there are in more distant districts other sources of wood to which these ores, owing to their excellence, would bear the expense of being carried in order to be melted down, especially if the railway tariff for goods in India were lowered a little, particularly for iron ores.

It may be here explained, for the benefit of the uninitiated, that iron ores are always carried to the fuel, and not the fuel to the ores, as, for the production of a given quantity of iron, a greater weight of fuel is required than of ore, especially when the ore is so rich in metal as that of Central India; besides that, owing to the smaller bulk of ore for a given weight compared with that of wood, the ore can under all circumstances be carried cheaper, and larger stores of it can be more conveniently kept.

There are very great varieties of wood in Central India, and most of them are hard woods, which makes them all the more precious for smelting purposes, as the quality of charcoal is proportional to its specific weight, and the harder the wood is the greater is the specific weight of the charcoal made from it.

It may be not unimportant to mention here that the method employed by the natives of India in the production of charcoal

is, to say the least of it, very primitive. They lop the branches off the trees and leave the trunks to their fate, or burn them and use the ashes as manure. With all this waste, native charcoal is well burnt, specifically heavy, and astonishingly cheap; near the forests it may be had at the rate of As. 4 per maund. Its weight is 17lb. per cubic foot. The German and Styrian iron works pay As. 12 per maund for charcoal weighing only 12lbs. per cubic foot, an article therefore of a quality nearly 40 per cent. inferior to that of Indian make and three times as dear.

Trusting that iron-making by hand in India will soon be counted among the things of the past, we may be allowed to record its method briefly :—

The whole arrangement, furnaces and tools, are exceedingly poor and petty; the smelting furnace is a shaft of clay, 1 foot square and 3 feet deep; this shaft is entirely filled with charcoal, and a charge of 40lbs. of iron ore is heaped up above this—then the lighting and blowing commences. The bellows consist of two cylindrical leather bags, which are pressed down alternately, whereby the compressed air is driven in a continuous stream into the oven through funnels of clay, situated about 9 inches above the bottom of the furnace. After a couple of hours blowing and several replenishings of charcoal, the smelting process is complete, when the master of the work draws from the bottom of the furnace with a pair of tongs an unshapely lump of iron (called in the vernacular “Lotah”) weighing from 18 to 20lbs.,—this is then dragged to the front of the building, when it is beaten with hammers till it is reduced to a disc of 6 to 8 inches in diameter and 2 inches in thickness. As the natives add nothing to the ore in the furnace, the loss of metal through slagging is considerable. In this manner the work is continued ceaselessly for 24 hours, after which the furnace requires repairing. During this time four labourers and one master are employed, the latter generally the owner of the establishment. The labourers relieve one another at the bellows, the master being employed in removing the “Lotah” as said before, and in mending the oven and funnels. These five men earn together during the 24 hours Re. 1-1, and turn out in this time two maunds of half-finished iron.

The refining and finishing processes are carried on in rough open forges, and the articles manufactured are horse shoes, spades, cramps, and other small objects. In the production of 1 to 1½ maunds of finished goods (in 24 hours) there is a waste of 40 or 50 per cent. of iron, the consumption of fuel being three maunds. Six men and four boys work at two forges, and earn in the aggregate Rs. 1-12. Therefore, for the production of 1 to 1½ maunds of finished goods from the ore (in 24 hours) there are employed 5 men in producing two

maunds of half-finished iron, and 6 men and 4 boys in converting this into 1 to $1\frac{1}{2}$ maunds of finished goods, or altogether 11 men and 4 boys, who earn Rs. 2-13. The total consumption during this time is of charcoal 9 maunds and of ore $4\frac{1}{2}$ maunds. The same quantity of iron goods made with the present European appliances would consume but $\frac{1}{3}$ rd of fuel and $\frac{1}{4}$ of ore.

Notwithstanding the simplicity of these processes, the iron turned out by the natives is of superior quality, and is selling very cheaply; so, for instance, a maund of horse shoes sells at Rs. 8 and of cramp-iron Rs. 6-8. These low prices are accounted for by the cheap fuel, the rich ores, the miserably cheap labour, and the absence of managing expenses.

As regards the fitness of the native iron worker and the native in general for European iron works, it must be admitted that he is for the present not so powerful or persevering as the European workman, but his strength and energy would improve with more plentiful and more generous diet, the means for which would be furnished him by the superior wages which industrial establishments conducted on European principles could afford to pay him.

We will now consider somewhat more closely the commercial side of the question of iron works in Central India, and institute a comparison between the cost of production and the sale price of finished iron, or, let us say for the present, of ordinary bar iron.

As the iron works would be erected, for the reasons explained before, as near as possible to the forests, the cost of transport of the ores must first be considered. This would be done in bullock carts, on average good roads, and over a distance of 45 miles. The consumption of a blast furnace in ore and fuel depends on its size.

According to the best experience, a blast furnace does not pay if it is constructed for turning out less than 15 tons of pig iron in 24 hours, and this is also the quantity of pig iron which would fully employ a simple but complete bar iron rolling mill.

A blast furnace, capable of producing 15 tons of pig iron in 24 hours, consumes daily—

1. 23 tons of ore, which would cost as follows :—

		Rs.
(a)	at the place of production, 8 annas per ton	... $11\frac{1}{2}$
(b)	carriage to the iron works, Rs. 3 per ton	... 69
2.	22 tons charcoal—	
(a)	at the place of production Rs. $2\frac{1}{2}$	... 55
(b)	carriage to the blast furnace	... 30
3.	Limestone; 3 tons @ Rs. 2	... 6
4.	Wages	... $28\frac{1}{2}$
5.	Management, wear and tear, &c.	... 70
	Total	... 270

The working of one blast furnace would, therefore, cost per 24 hours Rs. 270, and would produce 14 tons of pig iron at a cost price of Rs. 18 ($\frac{270}{15}$) per ton.

A simple bar iron rolling mill requires daily—

				Rs.
1.	15 tons pig iron, costing	...	...	270
2.	4½ tons charcoal (carriage included)	...	...	20
3.	14½ tons wood ditto	...	...	22
4.	Wages	...	...	108
5.	Management, wear and tear, &c.	...	...	120
Total				540

The working of the bar iron rolling mill would, therefore, cost Rs. 540 per day, and produce daily 12 tons of bar iron at the cost of Rs. 45 ($\frac{540}{12}$) per ton, or Rs. 1-10 per maund. With the present means of transport, the carriage of bar iron from the ironwork to Agra would be As. 8 per maund, which would, therefore, raise its cost price in that locality to Rs. 2-2 per maund.

Under the present charges of carriage by railway, the cost prices of bar iron per maund, in the principal markets of India, would be as follows:—

					Rs.	As.	P.
Agra	...	...	...	...	2	2	0
Alláhábád	...	...	...	...	2	8	0
Aligarh	...	...	...	...	2	8	0
Benáres	...	...	...	...	2	12	0
Bombay	...	...	...	...	4	1	0
Káhnpur	...	...	...	...	2	5	0
Calcutta	...	...	...	...	3	8	0
Delhi	...	...	...	...	2	5	0
Jalandar	...	...	...	...	2	11	0
Láhor	...	...	...	...	2	4	0
Ludíáná	...	...	...	...	2	12	0
Lucknow	...	...	...	...	2	4	0
Mírat	...	...	...	...	2	6	0
Multan	...	...	...	...	3	2	0
Ambálá	...	...	...	...	2	8	0

The sale price would, of course, follow the principles of fair competition. Swedish bar iron, Bowling, Low Moor, and Farnley iron are selling in Agra at about Rs. 7-8 per maund. This price, compared with our cost price, would represent a profit of Rs. 5-6 per maund, which would, however, be diminished as the markets recede from Agra towards Bombay or Calcutta.

Should there be a reluctance on the part of the Indian Government, for fear of seeming to counteract English manufacturing interests, either to lead the way themselves, or to take effective measures to encourage the introduction into India of European iron works, attention is directed to the half

products of iron which might be turned out in India and exported; kinds of iron and steel, which are now largely imported into England from other countries, such as "Spiegeleisen" of which, as mentioned before, large quantities are imported into England. Even America imports "Spiegeleisen" from Europe to the amount of 20,000 tons per annum. This quantity alone would employ four blast furnaces throughout the year, working night and day. The cost of making "Spiegeleisen" is 25 per cent. higher than that of ordinary iron; the cost price would, therefore, be about Rs. 25 per ton; the sale price in England is £6, in America 45 dollars per ton. "Spiegeleisen" being a product of the blast furnace only, the cost of machinery, furnaces, buildings, etc., for the refining process would be saved.

There are other half products of iron which England imports from abroad, such as *acier sauvage*, "glow steel," and raw steel." Of these half products of iron every ounce required by England, America, and other countries, should be supplied by India, owing to its excellent and cheap iron ores, fuel, and low wages.

The Iron Works of Dechauri, in Kumaon.

BY DR. H. WARTH.

THE Iron Works of Dechauri have been founded near a deposit of ore in the midst of forests at the base of the Himalaya range. The deposit consists of clay iron ore with a moderate amount of iron. The quantity of ore is very considerable. It occurs at the base of hills of Nahani sandstone. The ore is so plentiful that no mining at all is required. The ore is simply dug up and quarried over a surface of above 1 000 feet length along the hillside, and perhaps 300 feet width measured down the slope. It is not quite certain whether the deposit is conformable with the overhanging sandstone. The contact is not sufficiently exposed at the place of the outcrop. Very good ore crops out again on the hill in northern extension of the large outcrop, and further on in the river gorge strata which belong, most probably, to the Nahani sandstones, contain small layers of ore, and the deposit appears to thin out there. If this is really the case, however, the deposit of ore at the big outcrop is at least 100 feet thick, and there is no fear as to the ore being easily exhausted. The deposit crops out again at a distance of five miles at Kaladungi, where iron works have also once been erected. The ore at Kaladungi is poor. Amongst the Dechauri ore are different qualities. There are some very good beds, but poorer beds are always associated, where the ore becomes more and more mixed with clay. Owing to the large extent of the outcrop no deep cuttings have as yet been required, so that the succession of beds cannot be

generally followed. Some of the ore is pisolitic, and some ore contains rich nodules. There might be a way of enriching the ore by washing these nodules out of the clay. The following is an analysis of Dechauri ore :—

Peroxide of iron	...	...	54.6
Protoxide of Manganese	...	...	0.3
Alumina	...	...	16.4
Lime	...	...	2.0
Magnesia	...	...	0.5
Silica	...	...	17.9
Potash	...	...	0.2
Phosphoric Acid	...	...	0.6
Titanic Acid	...	...	0.2
Water	...	...	7.1
Total			99.8
Metallic iron			38.3

The Dechauri and Kaladungi ore is different from other ores of the Himalaya. It belongs to a recent tertiary formation; whilst other ores of the Dehra Dun District, Kotkai, Mundi, and Kangra belong to older formations of more or less metamorphosed slates or schists. Further it is a regular brown iron ore, whilst the ores in other localities are non-hydrated hæmatites or magnetic ores.

Ores of the latter kind abound also in Kumaon, and they have been brought into requisition for the Dechauri Works. These ores are found at a place called Khairna, and at Ramgarh, which latter place I visited. Ramgarh is, by a direct road, 23 miles from Dechauri. I went first to Nynee Tal, a distance of 15 miles from Dechauri. The Nahar sandstone strata are met along the road to a considerable height up to the ninth mile. I found in them impressions of fossil wood, and occasionally small nests of coal. Nynee Tal is surrounded by large masses of limestone. From Nynee Tal I proceeded along the Almorah road. After 11 miles is the Dāk Bungalow of Ramgarh. On the road the limestone is succeeded by slates mixed with quartzites and clays, and afterwards more or less metamorphosed slates occur. Beyond Ramgarh Dāk Bungalow the road leads into the Ramgarh gorge, and up the right side of it to the village of Lushgiani. The slates are at many places changed into complete micaceous schists. There is a mine called Pakha mine near Lushgiani, with many surface excavations, and one shaft 100 deep which was inaccessible. Very pure ore was obtained from here. Higher up on the top of the hill is the Gualakuri mine, 6 miles from the Ramgarh Bungalow, and 32 miles from Dechauri by the Nynee Tal road. It is an open outcrop worked like a quarry 100 feet long. The ore is about

20 feet thick, forming a seam of siliceous hæmatite (not a lode) with about half pure ore and half impure ore, and quartzite. From here a great quantity of hæmatite had lately been taken for Dechauri. About the seam is a stratum with a purple powder, probably containing manganese. The top layers are soft white mica schist. One hundred feet depth in the direction of the seam, which slopes towards the interior of the hill, and 100 feet width would represent above 300,000 maunds, which is enough for two years' consumption of the Dechauri blast furnace, (Dechauri blast furnace produced pig iron at the rate of 50,000 maunds per annum). Gualakuri being only one of a number of outcrops, it is evident that the amount of ore in the neighbourhood is quite up to the supply of iron works on a large scale. The configuration of the ground is such that the extension of the Gualakuri seam might just pass through the Pakhakhan mines. It is probable that the two deposits are identical, notwithstanding the change in the appearance of the ores. The following are analyses of some ores. The figures for Gualakuri are the average of three analyses. The ore mentioned as Lushgiani cannot be from another but the Pakhakhan mine. Natwakhan is a mine low down in the valley, which I did not visit.

Gualakuri. Lushgiani. Natwakhan.

Peroxide of iron ...	...	45.6	70.3	81.2
Protoxide of iron ...	...	9.3	12.0	...
Protoxide of Manganese	...	...	0.3	8.1
Peroxide of Manganese	...	0.7	...	...
Oxide of Alumina	...	4.2	3.9	3.4
Magnesia	...	0.5	3.2	0.5
Silica	...	38.2	8.2	4.2
Phosphoric Acid	...	0.1	0.1	0.1
Sulphur	...	...	...	0.1
Water	...	1.9	2.3	2.2
Total	...	100.5	100.3	99.8
Metallic iron	...	39.4	58.6	56.8

The Ramgarh ores, with the exception of Natwakhan, contain some protoxide of iron in addition to the peroxide. They are consequently more or less magnetic. Specimens of the ores influence a magnetic needle. Different sides of the same piece act in opposite ways on the magnetic poles. In no specimen did I find the magnetism so strong that the specimen would attract light iron filings. I found some very pure and highly magnetic ore similar to Gualakuri ore near the 9th mile on the road from Dechauri to Nynsee Tal. On both sides of the road pieces were lying about amongst debris of Nahan sandstone. They were much rounded at the corners, and generally worn at the surface. The rocks to the north were limestone, but the hill on the south side of the road might contain older strata underneath the debris, so that there is a faint chance that the pieces I found may have come from a deposit close by

instead of having been brought there by smelters. It is almost incredible what number of blast furnaces have been erected for the smelting of these ores. At Kaladungi, where the Nynsee Tal road from Moradabad begins to ascend, no less than four blast furnaces have been erected. In these it was intended to smelt the Kaladungi ores with charcoal obtained from the forests at the base of the hills. Only two of these furnaces have ever been worked, and all are at a standstill now. At Dechauri, Mr. Campbell, Superintendent, Rurki, showed me the old blast furnace with which he began making pig iron in 1857. His furnace was afterwards replaced by the larger one which has been at work up to lately. Besides this large works were begun at Dechauri by a company, consisting of two blast furnaces, a building for converting the pig iron and a building for rolling mills. The whole came to a standstill for want of funds. On the road to Nynsee Tal from Kaladungi, within only about five miles from the hill station near the Kurpa Tal (lake), are two blast furnaces with all their requirements now abandoned. Situated between Kaladungi and Ramgarh these had had the choice between the ores of both places, and for fuel they depended on the forests of the higher mountain regions. Lastly, in the valley at Ramgarh, there is the complete outer masonry of a blast furnace with the walls of houses now all overgrown with thickets. Thus there are no less than eleven blast furnaces to be counted in various stages of completion or of ruin, and of all these only one has been working of late, and even this one is at the moment standing still. With so many works failing from their commencement the conversion of the pig iron into wrought iron has been little attended to, and not at all practised of late.

I was very much pleased with a small hammer work at Ramgarh. Mr. Franken, the Engineer in charge of Dechauri, told me that in this the raw blooms made by the native process have been worked up into fit shape for commerce. It was the very thing which I proposed for Kangra in my report of 1874, (printed in the *Punjab Government Gazette*). An overshot waterwheel worked a blowing machine, consisting of two square wooden boxes with pistons, valves, &c. The blast was led to two hearths on which the blooms were heated with charcoal. Then there was a second waterwheel on a large horizontal beam. This beam had two rings and thumbs, which lifted two hammers of about six feet length each. This must have worked very well. There was also a Cupola furnace of 12 feet height. I would have thought that this was used for smelting the ore by the native process into blooms, but I was told that it only served for some experiments as to the quantity of iron yielded by the ores.

The blast furnace at Dechauri is 39 feet high, and has a diameter of 5 feet 3 inches at the stop, 10 feet at the widest part, and

3 feet 6 inches at the hearth. It is built of local sandstone, and lined below with small bricks made of a sandy fire proof clay, which is found embedded above the iron ore. The furnace is in every respect well fitted out. A canal brings water on an over-shot wheel which drives a pair of horizontal cast iron blowing cylinders, and a couple of water pumps. These pumps supply the lift which works from a reservoir on the top of the lift tower. The pumps also supply water for the cast iron watertugers, &c. The blast was heated in cast tubes of oval section, the heat being created by burning furnace gases only. The heat of the blast was very great, rising to 1,200 degrees Fahrenheit. Zinc has repeatedly been melted by the hot air. The furnace is closed at the top with a cone apparatus. The outturn, Mr. Franken told me, was at the rate of 50,000 maunds a year. The fuel was charcoal from the surrounding forest, and tufa limestone was used as flux.

The reason why the Ramgarh ores were used in addition to the Dechauri ores was not only their superiority, but the facility with which the process was carried on when the two ores were mixed. The Dechauri ore contains almost as much alumina as silica, and the addition of purely siliceous ores with limestone as flux must have proved an advantage. Only the Dechauri iron ore costs almost nothing, whilst the ores from Ramgarh cost very much in transport. The digging of the ores at Gualakuri cost less than one anna a maund, but bringing the ores down the mountain side on men's heads, costs two half annas per maund. Then from the Ramgarh depot the ore was once brought for eight annas a maund to Dechauri, but contractors not being available, the officer in charge had actually to purchase cattle, and take the transport of the ore into his own hands. The transport in the mountains is very difficult. Outside the mountains it becomes at once cheaper, thus the pig iron costs only five annas a maund to bring from Dechauri to the railway station of Moradabad, about fifty miles off. The production and transport of charcoal was not excessively dear, the only complaint being the exhaustion of a great portion of forest, and the deficient reproduction owing to deliberate grazing.

The following is an analysis of two kinds of slag from Dechauri :—

Slag.		Brown cinder.		Dark & glassy fracture.	
Silica	38.0	...	40.6
Alumina	10.5	...	17.0
Lime	20.6	...	23.6
Magnesia	1.6	...	1.9
Protoxide of iron	8.4	...	1.8
Protoxide of Manganese	9.0	...	12.1
Total		...	88.1	...	97.0

In the first case the large percentage of iron in the slag shows that the furnace was not working normally. The second slag from normal working shows by its proportion of alumina that a large admixture of Ramgarh ore had taken place. More than one-half must have been Ramgarh ore. Most of the product is grey iron numbered from 1 to 3, but I was also given some samples of white and of mottled pigs which formed part of 20,000 maunds altogether in store.

The following is an analysis of grey Dechauri pig iron No. 2:—

Iron	...	...	...	92.2	91.9
Carbon	...	...	...	4.0	3.9
Silica	...	...	...	1.7	1.6
Sulphur	...	...	...	nil.	nil.
Phosphorus	..	...	...	0.7	0.9
Manganese	...	...	...	1.2	1.3
Total				99.8	99.6

As already mentioned the work at Dechauri is at present standing still. Mr. Ness, Government Mining Engineer, Warora Colliery, was at Dechauri to report to Government on the future prospects of the works. His report, which will no doubt be obtainable after some time from the Government, North-West Provinces, will contain detailed information about the economy of the works.

From his report it will be seen why it is so difficult to render in these parts the iron manufacture on a larger scale remunerative. Besides the costly transport of ores, charcoal, and pig iron there appears to be a difficulty regarding the skilled workman. I found two European workmen at Dechauri who were about to leave, and there is no chance of the furnace work being continued by native workmen only.

I had the pleasure of witnessing some experiments which Mr. Ness made in reducing iron ore to metallic sponge. Not only the pure Ramgarh ores, but also the Dechauri ore, gave perfect metallic sponge on being heated in a crucible with charcoal powder.

It is desirable to manage the manufacture of iron in this country in such a way as to suit the capabilities of the local workmen. The work at the large blast furnaces seems beyond them, and Mr. Ness is endeavouring to introduce a simpler mode of working. It does not appear to me that he looks to the direct manufacture of wrought iron for this end, but it seems he would rather melt sponge down in charcoal furnaces with blast, and produce pig iron. By making the sponge first he would do away with the whole of the reduction process which is now occupying half the pace of the blast furnaces.

This way he will not only save much in the size of the blast furnaces, but by applying perfectly metallic sponge he will do away with the whole series of difficulties which arise at blast furnaces out of irregular reduction of the ore.

The native direct process of smelting is only applicable to purer ores, and even with them is always accompanied by a great waste of iron. Even where this waste can be afforded the process requires also so much fuel and labour that it competes rarely with imported English iron. With the greatest ingenuity it will not be possible to improve substantially the native process by mere changing of the manipulation and size or form of the apparatus.

The use of sponge in the direct process is known elsewhere, and wherever the native process should have to be practised, it would be well to take a hint from Mr. Ness and to reduce the iron ore before bringing it into the native smelting furnace. The process will be more regular, and where circumstances are favourable a saving may be effected.

Until some other invention is made it is indispensable for any improved system that pig iron be manufactured. The blast furnaces should be reduced to such a size that their working will be within the capabilities of native workmen, assuming that they are guided by an officer who has a theoretical and practical knowledge of iron making.

The size of a blast furnace may be reduced almost to any extent on application of the following measures :—The ore will all be roasted, or where it can cheaply be done Mr. Ness's proposals may be adopted, and the iron ore used in reduced form ; further the limestone used as flux will all be previously burned ; further the blast will be heated ; lastly, some allowance will be made for the smaller size of the furnace by greater expenditure of fuel. By a combination of these measures the size of a furnace may be reduced, so that there will be no reason why clever native workmen should not manage it under competent supervision.

The question remains then how the pig iron is to be made into wrought iron. To think of the Bessemer process is of course out of the question in this country.

The great discovery made by Messrs. Thomas and Gilchrist in 1879 is not destined to prove of advantage for Indian iron making.

On the contrary as Thomas and Gilchrist's invention makes it possible to Bessemer the pig iron obtained from inferior ores, the production of good wrought iron must in future become cheaper in Europe. Therefore, we must also expect that better wrought iron than heretofore will be sold in India at ordinary prices, and that the Indian iron will lose the claim of the superior quality.

Apart from the Bessemer and the Siemens-Martin process, which is also too elaborate, there remain only the puddling and the hearth-refining process, and of these we have to choose the latter. The hearth-refining process is not at all inferior to the puddling process. The chemical reactions are almost identical,

and it is only the difference in the fuel which decides for either of the methods. For charcoal the hearth-refining process is the one to be adopted. The amount of material worked at a time, *viz.*, the size of the blooms, can be reduced at will, and the work can be so carried on that the native workman will do it without any difficulty.

The consumption of pig iron and charcoal by this process are not excessive, and some saving of fuel can be effected by the application of hot blast. With a properly designed hearth the work can be done quite mechanically. The pig iron is smelted between the charcoal, and as it trickles to the bottom is acted upon by the blast, which oxydises through the medium of oxide of iron, the silicon, carbon, and phosphor. After the first smelting down, the partially refined metal, which has solidified at the bottom of the hearth, is brought again to the top of the charcoal fire, and again smelted down. Either this second or a third smelting suffices to produce a bloom of pure wrought iron, which only requires hammering out. This way of making wrought iron is very much to be recommended for Indian charcoal works, and it may be that preparations for this very process at and near Dechauri are only wanting, because the iron works did not mostly attain beyond the first stage of pig iron making.

On the production of Lac in Hoshiarpur District.

By W. COLDSTREAM, C.S., *Deputy Commissioner.*

THE district of Hoshiarpur lies between the Beas and Sutlej Rivers. Its surface is, roughly speaking, half plain and half occupied by the outlying ranges of the Lower Himalayas, corresponding to the Sivalik ranges east of the Sutlej. It may therefore be called a submontane district. Lac is produced in all parts of it, at least in the plains and in the valleys between the hills. It is more abundant in the latter.

It affects chiefly the Beri (*Zizyphus Jujuba*), and Kikar (*Acacia arabica*); but is also found on the following trees:—

Pipal	...	(<i>Ficus religiosa</i> .)	
Sirin	...	(<i>Acacia Sirissa</i> .)	
Barh	...	(<i>Ficus indica</i>)	... Banyan.
Pilkhan	...	(<i>Ficus venosa</i> .)	
Lasura	...	(<i>Cordia Myxa</i> .)	
Anjir	...	(<i>Ficus Carica</i> .)	
Dhāk	...	(<i>Butea frondosa</i> .)	
Phagūra	...	(<i>Ficus caricoides</i> .)	
Patājan	...		
Gular	...	(<i>Ficus Cunia</i> .)	

Thus it is found on six species of *Ficus*.

The lac produced by the various trees differs in quality. The Lac produced on the *Zizyphus* is deemed the best, and next to it comes that produced on *Sirris*, *Kikar* and *Pipal*.

There are two seasons for production—February to April, and July or August. The crops are collected in June, and October or November. The same tree is said not to produce two crops in the same year. The autumn or October crop is considered the more valuable of the two.

The artificial propagation of lac is understood by very few persons, but seems to be occasionally practised. The method adopted is to tie a small branch with the insects on it on the tree which it is desired to affect. The writer has found it very easy to propagate lac on *Beri* trees in this manner. The twigs containing cells of the insect were tied on to the trees in July; shortly after the new swarm appeared and spread over the nearest branches of the tree. There appears, however, to be among the people a great dread of the tree being injuriously affected by the spread of lac upon it, and this is probably the reason why propagation is not carried on to a greater extent. In cutting lac off a tree a few twigs containing cells are allowed to remain to furnish a crop for next year.

There existed a deep and widespread prejudice among Hindus against having anything to do with lac. This was particularly strong among the *Bhabras* (called in other districts *Saraogis*.) Lac was considered a kind of disease or leprosy of the tree, and to be an unclean substance. Its red color and its animal origin are sufficient to account for this prejudice. It has disappeared, to a great extent, within the last ten years, owing to the great value which lac acquired in the market. There have been, of recent years, many disputes in the Civil Courts as to the relative rights of landlords and occupancy tenants to take the lac from trees growing in an estate. The question was not discussed at the time of the Revenue Settlement of the District in 1852, lac having then but a small marketable value.

The crop of lac on roadside trees is sometimes sold by Government to a contractor, who is allowed to cut off twigs and branches of a certain thickness. In 1876 the lac on the roadside trees in *Unah pergunnah* was sold for more than Rs. 400. The crop, however, varies much in quantity from year to year, as does also the value of lac in the market.

Tea at the Andamans.

OUR readers may recollect noticing some time back the mention in these columns of the fact that tea planting was being tried at the Andamans. During the recent Poojah holidays we took the opportunity of a sea trip to Port Blair to pay a visit to "Aberdeen,"—the island of the Andaman group, upon which tea-growing has been commenced; and where also other growths are being experimented with. The land is slightly undulating, and rises only some 200 feet from the sea level. The soil is good loamy clay with sandstone, and the subsoil is of a character to afford excellent drainage. The general lay of the land, also, is favorable to natural surface drainage. The bushes, which are mostly Assam (rather mixed) hybrids, are planted about 5 ft. \times 4 ft. 6 in.; and at present are nigh four years old. They are of good height, and now require to spread. The general appearance is of the healthiest character; the wood is clean, and the leaves are as fresh and glossy as could be desired, while there is now a flush on which would make many a hill planter's mouth water; and there is an entire absence of blight of any kind.

The land is kept thoroughly well hoed, the earth is packed well up round the roots of the bushes, and the whole plot of land, where the tea is growing, is as clean as the beds on a well-cultivated flower garden; and yet from what we gathered, the labour force up to date has been small; but then it has been well directed and controlled. Unfortunately, the flush, which we have referred to as being now on the bushes, will be lost, because the factory is not yet complete. It seems strange that the P. W. Department should have allowed such a thing to happen, for, as we understood on the spot, it was not for want of due representation of the necessity for the earlier erection of the factory that the delay has occurred. However, a few months will see a very serviceable building completed, and it would be well if the authorities were at once to arrange for a competent tea maker to take charge, and give the experiment a fair chance; for it is no use growing good leaf if it is to be spoilt in the manufacture; and, although the extent of land at present under cultivation is small, an assistant would find ample occupation in clearing, cultivating, and extending, in addition to his supervision of the factory. The officer in charge at present is Lieutenant-Colonel Berkeley, who, himself possessing a tea plantation in the Nilgiris, is, besides, a good botanist and an experienced planter; but his duties at Port Blair, as Chief Commissariat Officer, are so multifarious and onerous, that, although he takes the warmest personal interest in this experimental tea garden, which does him so much credit, and although he has been thoroughly successful in its development, yet he cannot neces-

sarily devote that regular and close supervision which is necessary,—more especially so now that the bushes are arriving at maturity, and that constant manufacture will soon be required; for after March next, when the dry weather ceases, the flushes may be looked for in plenty, the climate giving for 8 months of the year that moist warmth which the tea plant luxuriates in and thrives so well under. In fact the climate may be compared to that of favorably situated Indian terai land, with this difference, of course, that there is always more or less of refreshing breeze from the sea; and, as the places where cultivation has been begun in earnest have been well cleared of trees and jungle, there is little or no fever.

It would, we think, be a matter for much regret if the Government should allow an experiment thus auspiciously commenced to fail of practical good for want of due continuous professional supervision; and we trust to hear soon that it has been resolved to provide Lieutenant-Colonel Berkeley with a competent assistant, able to carry out his orders, and to see to the minutiae of the factory and the garden. There are only too many planters just now out of employment, whose services could be secured at a very moderate salary; for living at the Andamans is cheap, and it is almost impossible to spend much money there,—all supplies being furnished through the Commissariat. As to isolation, in this respect a man would be not so badly off as in many parts of Assam. There are several European Superintendent employees on the Island, besides of course the settlement officials; and, as each departmental head appears to be provided with a boat and convict crew which remains at his command, it is a matter of only an hour or less to communicate with the different islands of the Settlement. (*En passant*, we may mention that anything more charming than a row or a sail on the clear blue sea inlets among the group of islands can hardly be imagined.)

In speaking of tea cultivation at the Andamans the question not unnaturally arises whether it is a desirable thing for Government to step in as cultivators to the possible injury of private enterprise elsewhere,—it being notorious that the supply of Indian tea is already greatly in excess of the demand. Well, on this point we can only say that, if we thought there was any intention of carrying the matter beyond the phase of a sufficiently large experiment with a view to demonstrate the practicability of successfully cultivating tea on the island, we should be the first to condemn it; but, as we take it, if ever cultivation on any large scale be attempted, the whole affair will be made over to private hands. At present there seems to be considerable objection on the part of Government to permitting the advent of free settlers, or non-official capitalists from outside. One reason for this is, perhaps, that as all the labour on the Settlement has to be performed by

convicts, and as the number of these (though amounting to some 12,000) is not sufficient for present requirements, it would be impracticable to afford colonists the necessary assistance of labour or protection of life. And if, again, coolies were brought from India, in any quantity, the civil administration would have to be strengthened. No doubt it will follow, as a larger number of ticket-of-leave men are accumulated on the islands, that many of the present disabilities surrounding free immigration will be removed; and we fully believe that a few years hence the population will be largely increased from within. Convicts, who have served ten years with good conduct, are allowed to marry, and numbers now are scattered about the Settlement as free labourers on their own account; and it appears that they are as a rule thoroughly well behaved, and so well off that few wish to return to their native land even had they the chance.

The Government, besides experimenting with tea, has tried coffee, but the climate seems unfavorable to the plant, as just at the time of year when rain is most wanted for coffee, there is least rain at the Andamans. Sugarcane, however, bids fair to be a great success, and cocoanut planting has proved highly profitable. In fact, almost anything will grow well there, and the grass is so luxuriant that hay to almost any extent might be manufactured. All these things of course would pay better if there were a sufficient local demand to absorb the yield of various kinds which the islands are capable of affording; and that is why we venture to express the opinion that Government would do wisely, as soon as it feels it can safely do so, to encourage settlement from outside. There are many men in India on pensions which permit them only close economy here, who would be able to live at the Andamans far more comfortably, could they take a small quantity of imported labour with them. Thus, cultivation would increase, farms would spring up, additional land would gradually be cleared, and a free population would in time accrue, affording protection rather than the reverse to the settlement.—*Indian Tea Gazette.*

Report on the Forests of Mauritius.

By R. THOMPSON, *Deputy Conservator of Forests.*

PART 1.—GENERAL.

THE Island of Mauritius lies in the Indian Ocean between the parallels of South Latitude $19^{\circ} 58'$ and $20^{\circ} 31'$; and East Longitude $57^{\circ} 17'$ and $57^{\circ} 46'$; and occupies an area of some 705 square miles. In shape it is an irregular oval, with the broad end resting towards the south. Its greatest length from *Cap Malheureux* to *Pointe d' Esny*, north and south, is 39 miles; and its widest part across, from east to west, 34 miles.

Districts.

2. For administrative and general purposes it is divided into nine districts as follows :—

		Area in square miles.
1. <i>Port Louis</i>	...	10.0
2. <i>Pamplemousses</i>	...	87.0
3. <i>Rivière du Rempart</i>...	...	58.0
4. <i>Flacq</i> ...	...	113.0
5. <i>Grand Port</i>	...	112.0
6. <i>Savanne</i>	...	92.0
7. <i>Plaines Wilhems</i>	...	70.0
8. <i>Moka</i> ...	...	68.0
9. <i>Black River</i>	...	95.0
Total		705.0

These districts are situated as follows :—

Rivière du Rempart and *Pamplemousses*, extending from coast to coast in the north; *Port Louis* on the west coast, south of *Pamplemousses*; *Flacq* on the east coast, south of *Rivière du Rempart*; *Moka* and *Plaines Wilhems*, the former lying wholly, and the latter almost wholly in the interior; *Black River* on the west coast, west of *Plaines Wilhems*; *Grand Port* on the east and south-east coasts; and *Savanne* on the south coast.

3. The total population of the Island in 1879 was 357,000 inhabitants, of which number the Indian population was 243,000, or very nearly two-thirds of the total. The average density per square mile of surface is therefore over 507 souls. The revenue of the Colony in the year 1878 was Rs. 78,95,536, and the expenditure Rs. 73,45,786, showing a surplus of revenue over expenditure of Rs 5,49,750.

The export in the same year of sugar, the chief article of colonial industry, was to the extent of 130,732 tons, and which was valued at Rs 3,36,17,848.

In the same year there were 122,000 acres of land under sugarcane cultivation, which amounted to just something more than *one-fourth* of the total area of the Island, which has been estimated at 451,200 acres. Taking it by districts, the following table shows the percentages under cane in each :—

	Area of District in acres.	Area in acres under Canes.	Percentage under Canes.
1. Port Louis ...	6,400 acres	...	...
2. Pamplemousses ...	55,680 "	8,650	15.0
3. Rivière du Rempart	37,120 "	12,250	32.4
4. Flacq ...	72,320 "	28,435	40.4
5. Grand Port ...	71,680 "	24,333	33.3
6. Savanne ...	58,880 "	18,845	32.2
7. Plaines Wilhems ...	44,800 "	13,350	29.7
8. Moka ...	43,520 "	11,175	25.5
9. Black River ...	60,800 "	4,950	8.0
Total ...	451,200	121,988	mean 27 p. cent.

In addition to sugar other principal exports from the Island are vanilla, aloe (*Fourcroya gigantea*), fibre, molasses and rum.

4. The following general description by Dr. Meldrum, Director of the Royal Alfred Observatory, is extracted and reproduced here by kind permission, from a paper read by him before the British Meteorological Society in June 1868. It is an accurate and complete general description of the Island :—

"The principal feature in the conformation of the Island is, that it consists of a central table land, which is separated from the plains on and near the coast, in some places by lofty mountain chains, in others by steep precipices, and in others by more gradual, but still rapid, descents. This table land comprises the whole of Moka and nearly the whole of Plaines Wilhems, together with the more inland parts of Flacq, Grand Port, Savanne and Black River. Its central ridge, which is the principal watershed of the Island, extends in an east by north direction, from the Savanne mountains in the south to the northern limits of Moka, over a distance of about twenty miles, and, like the table land itself, is most elevated in its southern half." (The table land in the extreme south has an elevation of 2,300 feet).

"From this ridge the ground slopes on either side forming here and there, at heights of 700 to 1,400 feet above the sea level, extensive and almost level plains, which, in some places, are abruptly separated from the littoral plains, several hundreds of feet below them, by almost perpendicular cliffs. The more gradual ascent in these intervals between the mountains commences at short distances from the sea, and continues up to heights of 1,200 to 1,800 feet, from which there is a similar

descent to the opposite coast. The railway from Port Louis (the capital of the Island) on the west, to Mahebourg, on the east coast, crosses the table land in a south-east and north-west direction; and the height of the stations determined by levelling, show the ascent and descent in that part of the Island. Thus, at four miles from Port Louis, the elevation is 392 feet, at eight miles 923 feet; at eleven miles 1,311 feet, and at sixteen miles, or about half way, 1,322 feet; the line then descends to 1,000 feet at twelve miles, 559 feet at seven miles, and 258 feet at five miles from Mahebourg. Generally, however, the table land is separated from the littoral plains, or the sea, by mountains of which there are three groups, viz:—

"(1). The Port Louis group in the north-west, the central line of which runs about twelve miles in an east by north direction, at four to eight miles from the sea." (Towards the north and west it throws out several spurs, with valleys opening towards the sea,—between two such spurs, in the south of the range, lies Port Louis the capital.) "The height of the range varies from 1,000 to 2,600 feet."

"(2). The Black River and Savanne group, consisting of a series of mountains and elevated ridges from 1,000 to 2,700 feet above the sea level." (They extend from Mount Rempart in the north-west to Mount Savanne in the south-east, a distance of over 14 miles. These mountains form the sea-ward scarp of the elevated table lands in the south-west corner of the Island. Viewed from the north, they present the appearance of high, well-wooded ridges, sloping away from west to east, and isolated wooded hills; but, as seen from the south, they present a bold and striking scarp, throwing out several irregular spurs, and valleys opening down to the sea. Everywhere the slope of this range on this side is steep with large surfaces of exposed rock.)

"(3). The Grand Port and Flacq group, in the south-east and east, rising to the height of 1,200 to 2,100 feet, and consisting of three main chains running nearly parallel to one another in a westerly direction, the principal chain being about fourteen miles long."

"Most of the main chains send off branches, which form a succession of valleys and gorges opening towards the sea. The upper portions of the mountains and elevated ridges are generally composed of bare rock, presenting here and there the appearance of lofty cones, peaks, turrets and serrated ramparts." (Several craters, still in good preservation, of extinct volcanoes, are to be met with on the Island, such as the *Trou aux Cerfs*, the *Grand Trou North*, and *Grand Trou South*; besides various others.)

"Between the bases of the mountains and the sea there are more or less all round the Island, low-lying and nearly level plains:

"Rivière du Rempart and Pamplemousses, north of the Port Louis mountains and portions of Flacq, are comparatively one extensive plain, the greatest elevation attained by the railway, which passes through them, being only 329 feet at a distance of six miles from the sea.

"The Island is drained by a great many rivers and streams, the largest of which take their rise on the table land, receiving in their courses numerous tributaries from the mountains, and, as they flow onward through deep-wooded ravines, forming in some places, picturesque waterfalls. They all vary in volume according to the season, and occasionally some of them become quite dry.

"Both in the interior and near the coast there are lakes, marshes and swamps. The principal of these are the *Grand-Bassin* in Savanne, at an elevation of 2,000 feet, and covering a superficies of from thirty to forty acres; the *Mare aux Vacoas* on the confines of Plaines Wilhems and Black River, about 1,900 feet above sea level, and having an area of about 200 acres; the *Mare aux Lubines* and others on the lowlands of Flacq; a number of marshes in the lower parts of Grand Port; and several ponds, swamps and marshes near the sea in Black River, and in the neighbourhood of Port Louis."

5. The principal rivers, and which rise from the table land, are the *Grand River South East*, having a course of 18 miles, *Grand River North-West*, a course of 14 miles, *Rivière du Rempart*, the *Tamarin River*, *Black River*, *Rivière du Poste*, besides numerous smaller streams. The two grand rivers, above mentioned, drain, through their affluents, the whole of the central parts of the table land; these affluents rise in the Median ridge between *Butte Chaumon* and the *Ripailles Estate* in the north, and within which tract is comprised the most important catchment area in the whole Island.

6. There are upwards of 350 miles of main public, and about 8 miles of district roads, kept up in a high state of efficiency. The roads are all laid down with *macadam*, which is maintained in good repair.

In addition there are endless private roads, maintained by proprietors of sugar estates, all over the Island. There are besides 86½ miles of made railways in excellent working order, viz., (1), North line, 31 miles, which leaves Port Louis and traverses the districts of Port Louis, Rivière du Rempart, Pamplemousses and Flacq, ending at Grand River south east; (2), Midland line, 35½ miles, which, starting from Port Louis, ascends the plateaux, and traverses the whole length of the districts of Plaines Wilhems and Grand Port, ending at Mahebourg on the east coast; (3), Savanne Branch, 11 miles. This branch leaves the Midland line at Rose Belle, in the Grand Port Dis-

trict, and proceeds in a southerly direction to Souillac on the south coast; and (4), Moka Branch, $9\frac{1}{2}$ miles *finished*, leaves Midland line at Rose Hill, in the Plaines Wilhems District, and traverses the whole length of Moka. It will ultimately be carried on to *Trois Ilets*, a further distance of 4 miles. It will thus appear that no less than eight out of the nine districts into which the Island has been divided, are provided with railways traversing their entire lengths, and which are carried along well chosen lines. As regards roads and railways, the Island is covered with them as with a net-work.

7. For purposes of this report, it is not necessary to enter into any minute description of the geology of Mauritius; what will suffice being a brief

Geology.
and rapid general sketch of it.

The Island is essentially volcanic, though what appear to be metamorphic rocks, occur as an older formation, in at least two places which are known to the writer. The first of these sedimentary beds occurs in the form of a small conical hill, projecting, as it were, out of and rising above the igneous mass, known as the *Rivière Noire* mountain, and is to be found at a spot which is half way up the side of this range, where the road from *Casé Royale* crosses it on the way to *Chamarel* Estate. From the plain below these beds can be recognized by the forest vegetation on them, which differs, not only in actual growth, but also in the species of which it is composed, and therefore has a distinct aspect distinguishing it from the surrounding vegetation.

The second instance of the occurrence of altered sedimentary beds is near the *Midlands* estate, in the centre of the Island; the place is known as *Mount-La-Selle*. The beds are crystalline chloritic schists, and have undergone considerable uplifting and contortion. They dip away to the south and appear to have a strike west by north-easterly.

On the south scarp there are found considerable quantities of coral and beach sand, above the line, separating the doleritic lavas which spread out below.

8. Doleritic lavas form the chief mass of the Island however, and present considerable horizontality on the manner in which they have been laid out immediately around, and sometimes considerably beyond, the volcanic foci which gave them birth.

Dolerite principal
rock.

In consequence of this tendency to horizontality, terraced and undulating plains have been produced, and which rise one above the other to the highest levels of the Island, one of these plains being at an elevation of 2,300 feet above sea level. The lower beds of these lavas are of great thickness, and are, apparently, equally horizontal with the upper beds, which are however of less thickness. Considerable scarps occur, due to denudation, at a short distance from the sea all round the Island,

and over which the rivers, rising in the interior, precipitate themselves, forming beautiful waterfalls and grand cascades—notably those of Chamarel and the Tamarind river. The mountain peaks and precipices, which are exposed to view, likewise exhibit in a marked manner a horizontal arrangement of the different lava overflows; these beds being defined by thin bands of ash and scoria interstratified with them. The mountains in the Black River district, however, exhibit only the lower members of these irruptive rocks, *vis.*, the *diorites* which form the axes of the range, the upper and more perishable *dolerites* having all disappeared under the action of sub-aërial denudation. It is not at all improbable that diorite, as being the lower rock, composes the mass of all the mountain chains of the Island. It would also appear that the volcanic action has long since ceased in those quarters, though considerable activity, during more recent times, has gone on in the middle of the Island; proofs of which are not wanting, since several extinct volcanoes have their craters still in good preservation. These later and successive overflows have raised the centre of the Island to its present form, and given to it its present elevation. The masses of lavas, which have laid down the terraces and formed the upland rolling plains, were evidently ejected through a chain of vents which occupy what is now the medial ridge of the Island, commencing in the south-east, and extending across, in a north-easterly direction, for a distance of 20 miles to the *Calabassas* mountains. These recent overflows would appear to have occurred in times when parts of the Island were covered with some sort of vegetation, for we find in some of the slags and scoria picked up, the charred remains of vegetable tissues in a sufficiently good state of preservation to leave no doubt of their identity. The existence of caverns and underground channels, into which small rivers frequently disappear and are not seen again, may also be pointed out.

9. As secondary minerals, associated with the Mauritian *dolerites*, may be noticed a very abundant *glassy* Secondary minerals. felspar, (probably *orthoclase*) so abundant that the rocks in which it occurs are porphyritic. *Pyroxene* also occurs in some of the ash beds, crystallized in acicular masses. *Calcite* has been found occurring, though rarely, as veins in the dioritic masses of the Black River mountains. *Magnetite* is a constituent of most of the later *dolerites*, and is abundant in the rocks near and around extinct craters, its presence there being detected by the behaviour of the magnetic needle.

Interstratified with the lavas occur bands of red and brown coloured *bole*, and which is present throughout the whole series. In various parts, especially above Port Louis and Petite Rivière these bands of *bole* are of considerable thickness. *Scoria* and *lapilli*, sometimes combined with *bole*, cover, as with a

crust, tracts of considerable extent in the higher levels of the Island.

The form, known as the columnar structure, occurs in these dolerites in some of the mountain ranges. A field of considerable extent of this structure may be seen on a part of the bambou range overlooking "*Trois Îlots*." Exfoliating concretionary forms are abundant wherever the rock masses are undergoing decomposition, notably in the lower parts of the Island, and also along some parts of the coast. Frequently *lapilli* in combination with *bole* occurs as a surface soil, such as may be seen in parts of Petite Rivière and du Rempart; such soils are dry and unfit for cultivation, except under irrigation; and frequently the hard spheroidal *cores* of concentric nodules are very abundant, such as one would expect to meet with in the trap fields of Western and Central India.

10. Diorite, which composes the chief mass of the Black River mountains, has imparted a peculiar physiognomy to that district. Since the rock is black (owing to a dark colored hornblende) the exposed surfaces everywhere present a peculiar sombre hue; even the boulders strewn in the beds of the torrents, which come out of these mountains, are black; as likewise are the gravels and other detritus occurring in the valleys.

11. In the decomposition of the dolerites there has resulted an extremely fertile soil. This soil is either red or brown in color, and is only in some parts of the Island of any considerable depth. However, as a rule, it is extremely shallow, and where only recently reclaimed from forests, carries a layer of *humus* of from two to six inches in depth. The presence of this *humus* makes the soil extremely fertile, and it is thus especially suited for the cultivation of the sugarcane. In the older reclaimed soils no trace of this *humus* now remains. It is well known that direct exposure to the sun's rays and to the dry heat of the air in summer causes the *humus* to decompose and to become dry and powdery, and in that state it is easily carried off and scattered abroad by the winds. Hence under a want of proper treatment, even a rich virgin soil, without it, unless kept shaded, quickly deteriorates, and is eventually lost to the sugar planter, who, on finding that the soil can no longer grow his canes, abandons it for land which may still be under forest.

The whole of the Savanne district, the greater part of Grand Port and Placq, Moka and Plaines Wilhems, are covered, more or less, by the red clayey soil alluded to above. The red tinge is derived by it from the hydrated oxide of iron formed during the weathering and decomposition of the doleritic rocks—the felspar, which these rocks contain in such abundance, being essentially a silicate of alumina and potash.

In the littoral, here and there, may be met patches of true black soil, containing a large quantity of organic matter; it is of highly hygroscopic quality, and parts but slowly with its moisture. During prolonged dry weather, however, large cracks appear in it. In India the black soil is considered extremely fertile. A form of decomposition of the doleritic rocks has been observed, being the disintegration of them into very fine gravel of a grey or greyish blue color. Such soils, when formed, are mechanically pervious to moisture, just in the same way that sand is, and like it forms a loose mass which readily parts with any moisture it may have received to evaporative agency.

These soils have no hygroscopicity, are always dry, and are of little value for short-rooted crops, except under irrigation.

They commonly occur in the lower parts of the Island.

12. The climate of Mauritius is tolerably equable, although it is capable of being divided into a warm and a cool season, neither of which is necessarily dry in the sense the want of rainfall would imply. It rarely happens that no rain falls during any month. The warmest months are the rainiest; but a considerable quantity of rain likewise falls during the cooler months; more especially is this the case in the higher parts of the Island directly exposed to the south-east trade wind.

The warm weather is said to last from November to April, January and February being usually the warmest months. The cool season lasts from May to October, June, July, and August being the coolest periods of the year. The seasons, as regards rainfall, are divided into the rainy and the comparatively dry. Since two-thirds of the annual rainfall are received between the months of December and April, these in consequence are considered the rainy months, although, as said before, there is no period of the year when it does not rain.

Situated in the midst of a wide ocean, and lying within two degrees of the Tropics, Mauritius may, comparatively, be said to be ever bathed in an atmosphere of vapour. Its small area, and that fairly well covered with vegetation, even at the present day, cannot be said to exercise any great influence in causing the moisture-bearing winds that blow over it from becoming drier; except in the sense that they part with some of their moisture in frequent showers of rain in their passage across the Island, and to effect which they are forced to rise to elevations of 1,800 to 2,000 feet above sea level.

The tables of relative humidity of the atmosphere, recorded in the Royal Observatory of Mauritius, show—complete saturation being equal to 100—that there is no period of the year when the humidity of the air, as thus measured, is below 30; and frequently it is as high as 90, when it may be said to show an atmosphere charged with moisture to repletion.

13. The mean annual temperature in the lower parts of the Island, as derived from the published tables of the Royal Alfred Observatory, and deduced from eight years' observations, 1871—78, was 74·5°. The mean of highest readings for five years, 1874—78, being 82·7°, and the lowest for the same period 65·6°, thus showing an annual mean range for the five years of 16·9°. The highest and lowest temperature registered during any day in any month of each of the five (1874—78) years was as follows:—

Year	Highest	Lowest
1874 88°	March 19th ... 61·5°	July 26th
1875 87°	December 21st... 61·2°	September 3rd.
1876 86·7°	January 3rd ... 57·1°	September 12th.
1877 88·5°	January 23rd ... 59·3°	June 25th.
4878 88·8°	January 6th ... 54·6°	July 3rd.

Means 87·8°

58·6° Range 29·2°.

14. By the kindness of Dr. C. Meldrum, Director of the Royal Alfred Observatory, Mauritius, we have been favoured with tables of annual rainfall and number of days in which rain fell, and which tables are hereto annexed. From these tables we find that the quantity of annual rainfall, and number of rainy days, have not decreased since observations were first commenced, and which date as far back as 1789. The following resumé will make this clear:—

During six years' observations taken at Port Louis, the mean annual fall of rain was 33·85 inches, and the mean annual number of days of rain was 100.

During a period of eighteen years' uninterrupted observations, taken in the same locality, that is from 1853—70 the mean annual rainfall is shown as 42·74 inches, and the number of rainy days as 128·6.

And for the eight years succeeding, i.e., 1871—78 (extracted from published Blue Books) the mean annual fall of rain has been 54·65 inches, and the mean number of rainy days 203·5. So that far from any decrease being observed in the annual fall of rain, or the number of rainy days, a considerable increase is apparent, during later times, if we compare the means for the three periods.

	Inches.	Number of rainy days.
1st period, 1789, 90, 91, and 1821, } 1827 and 1831 }	33·85	100
2nd period, 1853 to 1870 ...	42·74	128·6
3rd period, 1871 to 1878 ...	54·65	203·5

For stations situated in the interior of the Island, we find the average rainfall to have been as follows :—

Station.	District.	Elevation above sea level	Number of years of obser- vation.	Mean rainfall in inches.	Mean number of rainy days.
1. Mont Choisy	...	50	24	47.42	11.65
2. Gros Cailloux . Black River	...	60	9	33.11	86.5
3. St. Aubin ... Savanne	...	120	15	86.83	225.6
4. St. André ... Pamplemousses	...	170	18	47.00	153.6
5. Labourdonnais, Rivière du Rempart.	...	300	18	64.62	124.8
6. Gros Bois ... Grand Port	...	550	16	100.89	234.2
7. Beau Séjour... Plaines Wilhems...	...	950	19	71.05	189.9
8. Cluny ... Grand Port	...	1,000	16	151.66	266.1
9. Espérance ... Moka...	...	1,450	15	124.16	294.3

It will be seen that there is considerable diversity in the mean annual rainfall in each of the above nine stations, and which cannot be accounted for by elevation alone, but which rather depends on which side of the Island the stations are placed as well as on the conformation of the land in their immediate vicinity. These factors must, however, be considered in relation with the direction in which the prevailing winds blow,—and which, when they first arrive, are laden with moisture—both from the south-east quarter as the trades, and the north-west as the monsoons ; and also under the well known law, that as the air is cooled down, so will it part with the moisture it can no longer hold in solution. We have the necessary explanation as to why such diversities in the rainfall should prevail over a comparatively small extent of insular country, so favourably situated as Mauritius is with regard to its geographical position.

The following remarks are offered in further explanation of the above :—

During the cool period of the year the prevailing winds are the south-east trades. They are comparatively dry and cold winds, blowing from the Antarctic regions towards the Equator, and, meeting in their course, with comparatively no lands to further dry them until they impinge on this Island, their lower strata being considerably warmer and therefore holding a greater amount of moisture in suspension and which is derived from the expanse of waters over which they have blown. Arrived at Mauritius these lower moisture-bearing strata are forced to rise upwards in order to pass over the elevated table lands, and in their ascent are cooled down, and hence part with that moisture which they can no longer hold in suspension owing to the fall of temperature due to elevation. Should they pass over headlands, ridges, or mountains, before reaching the median

elevations of the table land, they will have then become considerably drier in the ascent,—it being also observed that the atmospheric air has a capacity for holding water in suspension in direct accordance with its temperature ; that when it is at the temperature of 60° of Farenheit's Thermometer, this capacity is doubled to what it could hold at 32° ; at 86° it will hold twice as much again as at 60° ; and so on. Hence when a warm, and in an oceanic region consequently a moist air, is cooled down to a temperature lower than before, it must part with the moisture which it can no longer hold, and which is then deposited in the form of clouds, rain, fog, or dew. But should the temperature be again raised, it will again dissolve and take up with avidity, to the extent of saturation compatible with the temperature it is at, all the moisture within its reach.

We can, therefore, after considering the above facts, understand why the south-east trade winds, which blow with considerable force, originally arriving laden with a certain amount of moisture, impinging on the high lands of Mauritius, becoming elevated and thereby cooled down, part at the temperature to which they have been lowered, with the moisture which they can no longer retain. And then as they pass away to the leeward side, where they necessarily descend to lower elevations, licking up as it were the train of clouds and mists which they had borne along with them in their passage across the higher parts of the Island.

The north-west monsoons, which arrive from the equatorial regions, and which are consequently warm winds, are laden with moisture to a degree compatible with the higher temperature they have attained. And in proportion as they are cooled down in their passage across the Island is the amount of moisture which they part with greatest. Hence the rainfall is greatest during the season when these winds prevail.

The following, by kind permission of the author, is extracted from one of Dr. C. Meldrum's published works :—

“ Generally, therefore, the annual march of the rainfall of Mauritius presents a double progression, having two maxima in February and August, and two minima in June and September. From September to January (the warmest months) the rainfall increases with the temperature, and attains its principal maximum in February, and from February to June, it decreases with the temperature. Instead, however, of decreasing with the temperature in July (the coldest month) it increases, and continues increasing till August, when it has a second maximum before attaining its principal minimum in September.

“ It would thus appear that, notwithstanding the diminished evaporation in winter (temperature being regarded as the principal agent) the low temperature of July and August causes a more copious precipitation than takes place, with a higher tem-

perature and greater evaporation, in May and June ; or it may be, that the increase of rain in July and August is partly due to an accelerated rate of evaporation in consequence of the strong dry trade wind which then agitates the surface waters of the surrounding ocean."

To which we add the following remarks :—

Another probable explanation of this may, however, be that during the winter the general temperature of the land is somewhat lower than that of the surrounding ocean, and that what little heat there is in it, is then parted with by radiation ; so that warmer currents of atmospheric air, arriving from off the ocean on to the Island, would be cooled down thereby, and would thus be forced to part with some of their moisture. Forests, it is now well known, diminish the loss of heat by radiation from the soil ; their presence, therefore, would tend to keep the general surface of the land at a more equable temperature, when, in such case, there would be less precipitation during the cooler months of the year, but which is greater in consequence of so little forests now remaining on the Island. Though the mean annual rainfall has increased in Mauritius, the general humidity of the air has diminished with the disappearance of the large primeval forests. Instead of an even saturation of the air with moisture, which forests tend to cause and maintain, it is now variable with a range into extremes.

The following is Dr. Meldrum's summing up of the general distribution of rainfall over the Island :—

"(1.) On either side of the Island the rainfall increases from the coast up to the highest station on that side, and attains a maximum at or near the summit of the eastern declivity, the line of maximum fall extending from near Labotir donnaïs, in the north, away to the southward, passing, probably, to the east of Espérance and to the west of Cluny, and thence to the neighbourhood of Grand Bassin and the Savanne Mountains, in the south, and along this line the maximum rainfall itself varies, and is greatest in the highest and most wooded parts of the Island near the commencement of the slope towards the east.

"(2.) The rainfall on the east coast is from two to three times greater than on the west coast.

"(3.) From the east coast westward to the highest stations on the eastern side, the increase of height is to the increase of rainfall nearly in the ratio of 5 to 2, and from the west coast eastward to the highest stations on the western side nearly in the ratio of 5 to 1.

"(4.) The rainfall at Espérance, one of the highest stations on the western side, is four times the rainfall at Gros Cailloux on the west coast ; and the rainfall at Cluny, the highest station on the eastern side, is a little more than twice the fall at Beau-Vallon and La Gaiété on the east coast, and five times the fall at Gros Cailloux.

"(5). If the other conditions be the same, the nearer the station is to the east coast the greater is the rainfall."

And then he goes on to say: "When the rain from the north-west is general, the relation between the east and west coasts, with regard to the rainfall, is reversed, which shows that the east coast owes its greater rainfall to its being on the windward side of the Island."

15. From an old and very interesting map of the Island, which was published in 1835, by Major F. A. Mackenzie Fraser, and lent to us for the purposes of this report by the Honorable E. Icary, it is seen that at that time nearly two-thirds of the total area of the Island was under primeval forest. There was then an unbroken mass of forest extending from the sea coast in the south, across to the Calebasse mountains in the north. The greater part of Savanne district was then under forest, likewise was also Grand Port, and the southern parts of the Black River district.

On the table land itself the forests then had only disappeared from Moka from a point near Mont Thérèse, and westward of it, and at Plaines Wilhems a considerable gap had then been created, while on the low country, and bordering the coast, all forests had been cleared away excepting small plots scattered about here and there, and evidently indicating that the land thus occupied was not culturable; for instance the whole of the Plaine des Roches and other tracts similarly circumstanced. The map from which these details are obtained is well worthy of preservation as showing the condition of the Mauritian forests forty years ago.

We now turn to another map, also kindly lent us by Dr. Icary, which was published in 1872, and mark the contrasts which this map offers in that year to what the other map did as respects the forests in the year 1835—that is, after the lapse of a period of 37 years. The great mass of the aboriginal forests from the central parts of the Island had then disappeared, and likewise they had also receded from the coast upwards into the heights. The whole of Savanne and a great part of Grand Port districts had likewise been cleared. So that from occupying an area equal to two-thirds of that of the Island in 1835, the forests in 1872 were reduced to about 70,000 acres; and at the present day the area of what were once aboriginal forests, but now more or less dilapidated and ruined, is reduced to about one half of the above, i.e., 35,000 acres. With the exception of such forests as the Crown holds, private proprietors, up to the present moment, are actively engaged in still further reducing these areas by extending the cultivation of the sugarcane, and by leasing the right to fell timber and to burn charcoal to the natives of India.

16. We will now describe, after having seen some tracts happily as yet spared, what the aboriginal forests of this Island were like in composition and character, and what a powerful influence their presence must have exercised at one time towards enriching the land, maintaining the waters in the various rivers, and keeping up a general condition of humidity in the air within reasonable limits of their boundaries.

The aboriginal forests of Mauritius may be said to have belonged to the class known as Evergreen Tropical Forest, and which, in the Island at the present day, are represented and reduced to a few isolated tracts, spared because they were either inaccessible, or because they contained no trees yielding valuable timber. The majority of the old primeval forests have however given way, through the agency of man alone, to inferior forest and scrub both as regards growth and composition, but which yet have, in some parts of the Island, acquired, by age and growth, a rank little inferior to the aboriginal productions they had replaced. These forests, of secondary growth, are mainly composed of species which have been introduced by man, and which have now, by time and the genial influences of suitable climate and soil, become subspontaneous; and have moreover, wherever the aboriginal vegetation has been destroyed, occupied its place with a persistency which is remarkable, and a vigor of growth which has left the indigenous inhabitants, wherever they have maintained the struggle, quite in the background; clearly indicating thereby that in the race with them for existence their insular brethren have no chance at least for the present.

Evergreen Tropical Forests are developed in countries lying within the Tropics, possessing climates which are equable as regards temperature, and in which the annual rainfall exceeds 75 inches. In an insular climate, like that of Mauritius, such forests are capable of development in regions where the annual rainfall is less, because of the general humidity of the atmosphere in proximity to the sea. However, in all the elevated parts of Mauritius the annual rainfall exceeds, and far exceeds, 75 inches, as will have been seen from the remarks already given in a preceding paragraph. In these evergreen forests, at all seasons of the year, great dampness of the soil and air prevails; and by the dense, almost impenetrable screen of foliage above, likewise a deep dark shade, so that light is almost excluded from them. The ground underneath is likewise covered over with a vast assemblage of associated species which render progress through such forests impossible, except by clearing paths through them. By the compactness of their growth and a certain special development, they bid defiance to the hurricanes which now and then visit the Island; and, though individual trees, composing the mass of vegetation, may, owing to the

little hold they have of the soil, be overturned by the mere weight of a man leaning against them, yet, owing to the stillness of the air, which at all times prevails within these forests, and is so maintained by the impenetrable mass, that the most fragile twig is as safe from injury from strong and violent winds, as it would be, were it growing in a well constructed hot house. It is this stillness of the warm air, combined with an enriched soil always surcharged with moisture, which accounts for the vast assemblage of species which are usually found occupying their recesses.

In Mauritius these evergreen forests do not attain any considerable height, which is probably due alone to the want of depth in the soil. The tallest trees rarely exceed 60 feet, and the average height is barely over 30 ; it is at this height that the impenetrable canopy overhead is formed, the taller trees piercing this, and remaining with their crowns considerably isolated in consequence. Such trees invariably develop buttresses, and have fluted and irregular stems in order to withstand the action of strong winds to which they are thus exposed.

The foliage is likewise peculiar, composed of thick leathery leaves with a peculiar gloss on them. The species with such leaves are capable of sustaining the deepest shade with impunity ; and it is in this property alone that hope lies that in many forest tracts now occupied by introduced species, the latter will eventually have to give way before the Mauritian species, which however are slow growers.

The species which attain the maximum of height, and which usually yield timber of marketable value are : *Calophyllum inophyllum*, *Canarium Colophania*, *Elæodendron orientale*, *Stadtmannia*, *Sideroxylon*, *Eugenia glomerata*, *Fetidia mauritiana*, *Sideroxylon grandiflorum*, *Imbricaria maxima* and *petiolaris*, and *Diospyros mauritiana*. Of trees which attain a medium height, and many of which furnish useful building material, may be cited : *Wormia ferruginea*, *Xylopia Richardii*, *Schmidelia monophylla*, *Pisonia culpidia* (the structure of the woody tissues of this is remarkable), *Celtis mauritiana*, *Sponia orientalis* (said to have been introduced), *Ficus mauritiana* and *Ayresii*, and the several species composing the genus *Tambourissa*.

As occupying marshy grounds the following are characteristic species :—

Calophyllum parviflorum, *Labourdonnaisia calophylloides*, *Sideroxylon Bojerianum*, *Stillingia lucida*, *Acalypha colorata*, and *marginata* ; and smaller undergrowth, such as *Jussiaea repens*, and *suffruticosa*, *Faujasia pinifolia*—a remarkable species belonging to the order *Compositæ* ; *Philippia abietina* which frequently attains a height of fifteen feet ; of *Dracæna* and *Pandanus* several species ; and *Smilax anceps*.

As composing the main body of these tropical evergreen forests and all loving the damp, humid, rich soils pervading

them, we have the following species, several being endemic :— Of *Anonaceæ* we have *Anona amplexicaulis*, *grandiflora* and *mauritiana*. Of *Bignoniæ*, characteristic species, such as *Erythrospermum mauritianum*, and *Alphoea mauritiana*. Of other genera we have *Pittospermum Senecia*, *Haronga madagascariensis*, *Asteria rosea*, *Dombeya*—several species. *Trochetia triflora*, a tree attaining thirty feet in height, the remaining species of the genus being however mere shrubs. *Ochna mauritiana*—which is endemic. *Hugonia tomentosa*—with its remarkable woody tendrils: *Erythroxylon laurifolium*, *Evodia obtusifolia*, *Zanthoxylon heterophyllum*, *Bursera obtusifolia*, *Quisiera mauritiana*, *Olea peitacorum*, *Cassipoua pinnata*, *Doratoxylon mauritianum*, *Cnestis glabra*, *Roussaea simplex*, *Grangeria borbonica*, *Weinmannia tinctoria*, *Paltoxylon mauritianum*, *Cassaria fragilis*, *Eugenia*—several characteristic species, *Mameoxylon trinerve* with one or two other species, *Polycias paniculata* and *Dichrostachya*. The order *Rubiaceæ* is largely developed by such genera and species as *Muscenda aruata*, and *Landia*, *Fernelia buxifolia*, *Antirrhoea verticillata*, *Platanonia*, *Myosima*, *Coffea*, *Psathura terniflora* and *myrtifolia*. We have likewise *Embelia mieraantha* and *Ardisia Sieberi*. Also such species as *Sideroxylon boutaniamum*, which grows into a small tree; *Diospyros Tessellaria*, *Chrysophyllos* and *Malanida*—all three of which are endemic. *Olea lancea*, *Ochrosia bourbonica*. Several characteristic species of the genus *Gaertneria*, *Nuxia verticillata*—a most elegant species when in flower—*Tabernaemontana telfairiana*, *pericariaefolia* and *Mauritiana*. *Colea mauritiana*, *Clerodendron heterophyllum*, *Mespilodaphne cuspidata*, *Hernandia peltata*—*Antidesma* (leaves with pitted swollen glands in their axils) such as *A. madagascariensis* and *rotundifolium*, and an undescribed species with opposite or sub-opposite leaves. *A. longifolium* and *Boutonia* likewise occur in the damp evergreen forests. *Phyllanthus anomalus*, *phillyneaeifolius* and *lanceolatus*. *Claosylon limostachys*, *Mallotus integrifolius*. Several species of the genus *Croton* of shrubby virgate habit. Besides the order *Onchidaceæ* which is represented by 23 genera and 75 species. Several palms, which however have nearly all disappeared from the forests, except as immature plants, owing to the upper stem (palm—cabbage) being prized for salads. We have likewise *Flagellaria indica* occurring at all elevations in the damp woods.

Of small herbaceous plants and shrubs, such of them as are implied by the occurrence of *Impatiens Gordonii*, *Phyllis mauritiana*, *Dodonaea viscosa*, *Sarcocolla Kanigii*, *Bryophyllum calycinum* and *Nesaea triflora*, likewise occur; also genera and species of the following orders: *Cactaceæ*, *Loranthaceæ*, *Compositæ*. *Plantago major* and *lanceolata* also occur in the higher parts of the island. *Ehretia petiolaris*, *Trichodesma*—several species. *Heliotropium indicum*; several species of the orders *Convolvulaceæ*

Solanaceæ, and *Piperaceæ*; of the latter, such as *Piper subpelletatum*, *borbonense* and *oxyloestire*; and likewise several herbaceous species of the genus *Euphorbia*.

Of Ferns a large number; *Cyathea canaliculata* and *excelsa*,—the latter attaining to a height of thirty feet in the forests of Grand Bassin; where also occurs the other arborescent Fern, *Dicksonia abrupta*, besides several grass-like species belonging to the natural order *Cyperaceæ*.

In the warmer parts of the Island occur such species as the following:—*Cissampelos Pareira*, *Sida* several species; also genera such as *Abutilon*, *Urena*, *Triumfetta*, *Hibiscus*, *Thespesia populnea*, *Waltheria indica* (which in India usually occurs in dry sandy soils) *Elaeocarpus*, two species, and *Ammannia vesicatoria*.

17. These forests have been called into existence by the agency of man, who, by felling the aboriginal jungles, and introducing many new and foreign species to the Island, where the latter having found a climate and soil suiting them, have multiplied and overrun every available spot they could fix upon, and from which the indigenous vegetation had been previously removed. These subspontaneous species, in some parts of the Island, form tolerably dense forests which are affording considerable shade and protection to the soil, and are likewise enriching it with their debris. But these forests do not form that impenetrable green canopy above, so characteristic of the evergreen forests. The species which mainly compose these forests of secondary growth are such as *Tetranthera laurifolia* and *monopetala*, *Albizia Lebbek* and *procera*, *Acacia arabica*, *concinna*, and *Fornesiana*—the latter prevailing in the lower parts of the Black River, *Tamarindus indica*, *Psidium pomiferum* and *Cattleyatum*—the latter forming a considerable proportion in some of the forests. *Eugenia uniflora*, *gamboa*, *malaccensis* and *jambolana*—*Ehretia serrata*, *Cinnamomum zeylanicum*, *Excoecaria sebifera*, *Entada scandens*, and *Ravenala madagascariensis*. The latter forms almost pure forests in the middle part of the Island, east of the Midlands Estate, and which are simply indescribably beautiful in appearance.

As forming dense and impenetrable undergrowths are *Rubus moluccanus* and *Lantana camara*. In fact these two wide-spreading shade-yielding plants have exercised a considerable influence towards ameliorating evil effects of the general deforesting which has been carried out with such vigor in Mauritius, by quickly taking possession of, and shading the soil, and thus preventing insolation which is so destructive an agent in causing decomposition of the vegetable matter (*humus*) of the soil. When the land becomes again covered with trees, these light loving shrubs will then die out; but meanwhile they are serving a useful purpose.

Of other introduced and now generally cultivated species the following are a few of the more prominent, namely :—*Casuarina equisetifolia*, *Anona muricata* and *squamosa*, *Cananga odorata*, *Ariabotrys odoratissima*, *Wrightia tinctoria*, *Alstonia scholaris*, *Tectona grandis*, *Ficus bengalensis*, *macrophylla*, and *religiosa*, *Pithecolobium dulce*, *Dillenia speciosa*, *Castanospermum australe* (the Moreton-Bay Chesnut) several species of Eucalypts, *Hiptage Madagblota*, *Hematoxylon campeachianum*, *Cassalpinia Bonducella*, *sepiaria* and *Sappan*, *Terminalia Arjuna* and *Calappa*, *Persea gratissima*, *Melia Azedarach*, *Flacourtia Ramontchi*, *Reinwardtia trigyna*, *Moringa pterygosperma*, *Citrus Hystrix* (now naturalised) *Erythrina indica*, *Parkinsonia aculeata*, *Adenunthera pavonina*, *Berrya Ammonilla*, *Bassia longifolia*, *Spondias dulcis*, *Phyllanthus distichus*, the mulberry, *Jatropha Curcas* and *multifida*, *Euphorbia Tirucalli*, *Aleurites moluccana*, *Ananassa sativa* (now quite wild), *Lodoicea Seychellarum*, *Pandanus utilis*, the Vanilla, several species of bamboo, and *Panicum acariferum* which forms splendid hedges in the higher parts of the Island. Also such trees as the Jack, the Bread Fruit, Mango, Litchi, Peach, Plantains and Bananas, Coconut and a great variety of other edible fruit-bearers.

Of small growths are :—*Argemone mexicana*, *Cardiospermum Halicacabum*, *Psoralea corylifolia*, *Crotalaria*—several species. *Tephrosia purpurea*, *Wikströmia viridiflora* (now naturalised), *Cassia*, several herbaceous species, &c., &c.

The season of vegetation, as regards the indigenous flora, is continuous all the year round, there being, however, a general shedding and renewal of leaves during the cooler months of the year. As regards introduced species, which are chiefly of deciduous habit, they follow the general law of such species, and are deciduous during the months of July and August, even at a period when there is a considerable quantity of rain falling, and while the air and the soil are both charged with moisture.

In the structure of the wood, of evergreen indigenous species, no clearly defined annual rings of growth can be discovered ; and this is the case with all the Mauritian species of which the timber is valued. Hence no remarks are offered as to annual rate of growth ; but judging from the rate of growth observed in introduced species, it must, compared with these, be slow,—no measurements of actual rate of growth being however available.

The total revenue for the five years was Rs. 39,660, of which the heaviest item was on account of leases for the right of shooting on Crown lands, namely Rs. 18,206 ; and next to that by sale of timber to a contractor Rs. 10,540.

Forest Revenue and
Expenditure for 5
years, 1875-79.

The total expenditure was Rs. 1,48,503, salaries occupying the largest share of it, namely, Rs. 88,256 ; the next heavy item is on account of plantations, namely, Rs. 35,032 ; and various

other sums for raising young plants, planting up school premises, &c. The cost of uniform for forest rangers is put down at Rs. 6,712, and for hutting and medical treatment of the force, Rs. 2,638. (*To be continued.*)

The Changa Manga Working Plan.

DEAR MR. EDITOR,—I am sorry to have angered Mr. Baden-Powell, as I see by the last FORESTER I have done. I quite agree with him in all he says about the advantage of working plans and the necessity of making a beginning, however imperfect it may be. My letter was written in a hurry, and probably I didn't write plainly, though knowing what I meant it seemed clear enough to me at the time. My remarks were not aimed at the Changa Manga Working Plan, but against its meteoric character. The original plan was printed and circulated even to us outsiders, but not a sign has been made since. Although several years ago, some of the provisions of the plan as to thinning, &c., had been carried out to my knowledge, yet no information was given as to whether they agreed with, or how they differed from, the forecast. To one who had seen the working plan and heard nothing further, would it not seem fair to conclude that everything was going like clock-work? And on the other hand to one, who like myself had come to know that all had *not* gone exactly as the plan said it should, it was fair to conclude that the present forest officers were ashamed of the plan? By all means let us have working plans drawn up and published abroad, but let miscalculations be equally widely notified, or such plans become, not only useless, but even misleading to all but those who have the carrying out of them. Let me then ask once more that some officer, who has the opportunity, will send you a short memo showing in what way the Changa Manga working plan differs from the stern reality of facts.

GHATI.

Felling Trees in dense Forests.

SIR,—On reading Baboo S. C. Chuckerbutty's note on felling trees in dense forests, printed in your last number, two points struck me as calling for further remark. One is, that in practice it is not feasible to mark the tree for felling on the side on which it is eventually to fall. The mental labour involved in choosing trees for felling is great enough already, and must not be enhanced by the extra trouble which would result if we had also to determine in which direction the tree is to fall. This can be done afterwards, and, if necessary, a blaze may be utilized as a mark for this purpose. But when engaged in selecting trees for the axe, nothing should interfere with the operation; it requires one's whole mind, and anything that

ends to distract one's thoughts will invariably result in a bad selection. Moreover, to determine the direction in which a tree is to fall, it is generally necessary to stand at the foot of the tree, whereas to select the tree for felling it is certainly better—at least in hill forests—to stand at some distance from the foot of the tree in order that you may see its crown, and how it is situated with regard to its neighbours. The mark suggested by the Baboo should be put on, but not until the selection is entirely finished.

The second point is, that in dense fir forests in the hills, it is absolutely impossible, I believe, for men to climb up the larger trees—in which case alone it matters—and cut off branches and creepers; it is at least so dangerous that a *pahari* will not do it even under the temptation of a large reward. If the forest has grown up in a dense mass, there are no branches low down, and the only aid to climbing would be the stem of the creeper, and this is practically useless. Otherwise I concur entirely in what the Baboo says, and think his suggestion eminently practical and important.

S.

DEAR MR. EDITOR,—I sent you some time ago an account of the "Parish" tree of these parts. Reading an account of a native *tamasha* (given as "Tawadeintha"), in which mention is made of a wonderful tree called "Padaythabines" (those Burmese must have steel jaws), and which bears a strong family likeness to the dear old 'Parish,'—will you or one of your readers give us a short note on the tree represented by the above 12 letters, beginning with a P? Can it be possible that these are some of the imperfect forms from which the familiar Xmas Tree has been evolved by the selection of the fittest? A happy prosperous New Year to the *Forester* and a merry Xmas to its Editor is the wish of

GHATI.

Preservation of Timber.

SIR,—The following extract from a letter I have lately received from Colonel Pearson may be of interest to your readers.

Yours faithfully,

DEHRA DUN, 12th December 1880

FRED. BAILEY.

"I believe that after trying all sorts of experiments in France, all the lines have come back to two sorts of sleepers, viz., creosoted beech and creosoted pine or fir. The Northern line, which probably uses more than any other, hung long on to soft woods and the De Boucherie process. But they have now concentrated their whole works at Villers Cotterets, where they have an immense *Chantier* and apparatus for creosoting beech, and they use that only. Creosoted beech is considered equal

to oak, and costs just about the same. They have entirely given up all the sulphate of copper and zinc processes as useless. The same may be said of the Lyons, the Orleans and the Midi Railways, which use creosoted fir. They too long tried cheaper processes "*flambage and goudronnage*" and sulphates of copper and zinc, but the latter rotted the pine wood, and the former did not pay for the labor and expense of preparation, and all I believe now use nothing but creosoted beech or pine.

"The Eastern line use a small quantity of oak, as there is a good deal of small oak about these Departments which does for sleepers and not for much else. These are equal to creosoted beech,

"I think in India you might try scorching and tarring (*flambage and goudronnage*) the *longifolia* and *excelsa*. The scorching is done in an iron cylinder, which is put in the fire and turned round. When the sleeper is sufficiently burned, it is taken out and well smeared over with tar. I believe the tar is made from the roots of the trees. This answers fairly well in dry ballast or gravel. I think very probably it might answer in India."

Note on the destruction of the leaves of Sâl trees by a species of Lepidoptera.

It was noticed in October 1878 that a caterpillar was destroying the leaves of Sâl trees in the Eastern Duars and in the Goalpara district, but the extent of these ravages were not fully apparent till the following February.

At the commencement of that month every leaf of the Sâl trees, in a large forest of about 200 square miles in extent, had been devoured. In this tract, which is called the Purbotjuar and Guma forests, and which I visited in its northern and most southerly extremities, and in which Sâl almost everywhere constitutes the predominant species, I found the Sâl trees were perfectly bare of leaves, and the ground strewn with their debris and with the caterpillars' dung.

Other trees were also attacked, especially *Careya arborea*, and even the tea-plants of a garden which had lately been opened out in the neighbourhood of the forest.

I regret that I cannot give a scientific description of the insect and larva, but I drew up the following account of it, at the time, from a specimen before me, which I offer for what it may be worth to the readers of the *Forester*.

The body of the caterpillar is orange colored, covered with hairs of the same color, and bears a black stripe between two prominent tufts of hair on his back. The head is large, and with the rump is of a brighter orange than the body, and bears a black triangular mark.

The full grown caterpillar is about 2 inches in length.

The web of the cocoon is thin, and the latter is supported amongst the Sâl leaves.

The mouth is of moderate size, and insignificant appearance, cream colored and downy.

I collected several hundred chrysalids intending to send specimens for identification, but they all died—whether from a disease, or ichneumons, I cannot now determine. Since May 1879 I have not noticed a single specimen of the insect.

The months of March and April in 1879 were unusually dry, and hot winds prevailed to a degree almost unprecedented in this part of India. Forest fires were in consequence far fiercer than usual, and the whole of the tract I have referred to was burned, with the exception of a small area.

In the northern part of it I saw the forest on fire, the flames reaching to the tops of the trees, and many trees, of the nature of poles, were thus killed outright.

Whether this hot, dry, season brought on a disease amongst the caterpillars can only be left to conjecture, but the caterpillars disappeared equally from the unburned area as from the rest of the forest.

That the fire did not destroy them was soon ascertainable, as I noticed that the new leaves put out from the trees in May were being devoured by young caterpillars. I had also noticed the mortality among the chrysalids before the northern part of the forest had been burned, which was on the 25th March 1879.

The caterpillars prevailed over a much larger area than the one I have described, the more westerly forests in the plains of the Eastern Duars suffering the most, but large portions of the Sidli Forests to the last escaping its ravages.

I also noticed that patches where the forest growth was densest and finest, and probably the soil and air dampest, had escaped; whilst forests of more scattered growth, and where more damage had been done to the trees by jungle fires, were stripped of their leaves.

This may have been due to the caterpillars being unable to attack leaves full of strong acrid juice, which would be of less effect in the less vigorous portions of the forest. But in the Purbotjuar and Guma Forests not a tree escaped as far as I could see.

This forest is situate on a raised plateau of red loam and gravel, and contains a few rocks of the same strata as in the Garo Hills.

Some of the villagers of the neighbourhood informed me that there had been a similar attack of caterpillars within their memory.

It is worth noting also that probably in consequence of short supply of water, the jhoras being unusually dry owing to the hot winds, that cholera was very bad that season in Guma, but stopped when the rains commenced in May.

W. R. F.

II. OFFICIAL PAPERS.

On the bark of *Broussonetia papyrifera* as a material for paper-making.

Memorandum by D. BRANDIS, Inspector-General of Forests, on the bark of Broussonetia papyrifera as a material for paper-making, —dated the 29th November 1880.

IN a memorandum on the subject of the cultivation of bamboo for paper stock, dated 8th July 1875, I made the following remarks regarding the Paper Mulberry:—

In conclusion, it may not be out of place to draw attention to a tree which is grown largely in Japan as coppice wood on a short rotation, similar to osier-beds, and which furnishes a large proportion of the paper stuff used in the country. This is the Paper Mulberry (*Broussonetia papyrifera*: 'Forest Flora of North-West India,' page 410.) This tree appears to accommodate itself readily to different conditions of climate; it thrives in Western Europe, on the South Sea Islands, and in Siam, and there seems every reason to believe that its cultivation may succeed in North-West India. I know few trees more promising (in a suitable climate) for the supply of paper stuff on account of its free and rapid growth and the abundance of its fibre.

In the report on the progress and condition of the Royal Gardens at Kew during the year 1879, just received, the following passage regarding this subject occurs:—

Broussonetia papyrifera.—'The bark of the well-known Paper Mulberry supplies the material from which the tappa cloth of Polynesia and the bulk of the paper of Japan and China is manufactured. The Japanese cultivate the plant very much in the same way that we grow osiers, and they use only the young shoots for the manufacture of paper. A sample of the bark, which came into the hands of Mr. Routledge, is stated by him to be 'nearly, if not quite, the best fibre I have seen.' * * * * * 'I must admit it is even superior to bamboo.' * * * * * 'It requires very little chemicals, and gives an excellent yield—62·5 per cent. in the grey, i.e., merely boiled, and 58 per cent. bleached.'

The tree is indigenous in the Upper Salween forests of British Burma, and as soon as reserves have been demarcated in that district, and officers placed in charge, efforts should be made to establish regular plantations. In March last I visited, on the banks of the Maytharouk River, a settlement of paper makers from Siam, engaged in making the well-known snow-white paper which is sold in the bazaars in Burma. The procedure is of the simplest character, and the great advantage of this fibre is that it is white naturally, and that it is readily cleaned. It should also be cultivated as an experiment by forest officers at other places in Burma, in forest gardens, or regular plantations.

And I would recommend that it be tried at the Sitapahar and Bamanpokri Plantations in Bengal, at Shillong, and at the Kulsi Plantation in Assam. It is not impossible that it will be found to succeed elsewhere in India, for the tree thrives in Western Europe where it stands frost and snow, in China and Japan, and on the South Sea Islands.

The Fuel Tramway for the Punassa Reserve.

From the Honourable C. Grant, C.S., Officiating Secretary to the Government of India, to the Chief Commissioner of the Central Provinces, No. 729 F, dated Simla, the 8th November 1880.

SIR,—In reply to your Assistant Secretary's letter No. 3206—176, dated the 2nd September last, I am directed to communicate the following observations regarding the construction of a branch line to facilitate the carriage of fuel to the Holkar and Neemuch State Railway from the Punassa forest.

The original proposal was that a light tramway, 20 miles long, should be constructed by the Forest Department, at a cost of Rs. 1,05,500, to be worked by bullock power.

2. The present proposal is different. It amounts to the construction of a branch line to Punassa to be worked by the State line engines and rolling stock. The outlay for the construction of this line, I am directed to observe, is not likely to be less than Rs. 5,00,000, and will probably be more. Such a line must be constructed and maintained by the Railway Department, but it may be necessary for the Forest Department to make a contribution to the capital outlay. This, however, is as yet an open question. For the purpose of estimating the rate which should be paid for the fuel delivered by the Forest Department on the line, it may be assumed for the present that a contribution of Rs. 1,50,000, or about one-third of one year's net forest revenue of the Central Provinces, will be made from forest revenues towards the construction of the branch line.

3. There seems to be no prospect of burning coal at a reasonable cost on the Holkar and Sindia-Neemuch State Railway, and it would be a great advantage if arrangements could be made to furnish the needful supply of wood fuel for working the line from the Government forests in the Central Provinces. The following figures show the quantity of wood consumed on the line during the last 12 months:—

		Cost	Mean cost per ton.
	Tons.	Rs.	Rs.
2nd half of 1879	... 7,537	56,472	7.49
1st half of 1880	... 8,608	71,988	8.36
Total	... 16,145	128,460	7.96

The total length of line, when opened to Nasirabad, will be 388 miles, and the annual consumption for the entire length is estimated at 40,000 tons. Of this quantity, it may perhaps be possible to provide for a portion from local sources, but it would be very desirable if arrangements could be made to supply 30,000 tons a year from the Punassa reserve or from other forests in the vicinity of the line in the Central Provinces.

4. Before the Railway Department can undertake the construction of the branch line, it should be clearly ascertained whether the advantages expected will justify the outlay. The first question which should be considered is this:—How large a portion of the requirements, which are at present estimated at 30,000 tons a year, can be supplied permanently from the Punassa reserve and from other forests in the vicinity, the produce of which can be profitably exported by the branch line proposed to be constructed?

5. From the memorandum which is appended to Mr. Lindsay Neill's letter of the 30th January last, it is gathered that Major Doveton estimates the annual yield of the Punassa reserve, if worked with a view to the improvement of the forest, at one million cubic feet (which, it is presumed, means stacked wood) per annum. Assuming (which is probably not far out) that 90 cubic feet of stacked wood correspond to one ton, this would be about 11,000 tons, amounting to two-thirds only of the present consumption, or to one-third of the probable annual requirements of the railway in future.

6. The second question is, whether the rate at which the wood can be delivered alongside the tramway by the Forest Department will be so low that the saving in cost will justify the construction of the branch line. If the line is constructed it will be convenient to fix a rate per ton or per 100 cubic feet, to remain in force for the next three years, and to be subject to revision at the end of that period. Accordingly I am directed to request that you will, in communication with the Conservator, determine the rate at which it will pay the Forest Department to deliver 30,000 tons of fuel annually or a smaller quantity, if arrangements for the entire supply cannot be made. The President in Council is of opinion that in addition to the cost of cutting and carriage, the rate should include the cost of cultural operations, which must doubtless be undertaken on a large scale, in order to ensure the reproduction of the forest growth; as well as an allowance sufficient to cover the cost of protection and management, including establishments, interest at the rate of $4\frac{1}{2}$ per cent. on Rs. 1,50,000, distributed on the estimated annual yield, and such a rate of revenue as in your opinion Government ought to derive from the land.

In making this estimate, it should be remembered that the forest will have to be opened out by a system of roads, for the construction and maintenance of which provision must be made. Further, that the arrangement of cuttings will require great care and skilful supervision in order to guard against injury to the young growth by frost and drought, and that the protection of the forest against fire must be made absolutely certain. Nor should it be lost sight of that the first effect of the construction of the branch line, and the extension of the forest operations, will be to raise the rate of labour.

7. As far as may be compatible with these considerations, the rate to be paid for the fuel should be fixed as low as possible, for unless the saving in the cost of fuel justifies the outlay, the railway cannot undertake the construction of the branch line. The railway demand for a large annual supply of firewood will afford an excellent opportunity for utilizing the resources of the Punassa reserve and the adjoining forests. It will tax the skill of the forest officers in the Central Provinces to the utmost to manage these forests in such a manner as to make them suffice for the large calls upon them. The task is one which should, if possible, be undertaken by the Forest Department of the Central Provinces. But the conditions must be such that the revenue derived from these operations shall be sufficient to furnish the means for managing, protecting, and improving the forest.

8. When reporting on the two questions here noted, it will be well to state the rate at which the Conservator of Forests is prepared to deliver the sleepers required for the construction of the line. Your proposals on these subjects should be submitted as early as possible, after the Conservator has had ample time to consider in detail the quantity of locomotive fuel that can be furnished by the forests, and the rates which should be charged for the wood.

On Cinchona Planting in the Toungoo Hills.

Memorandum by D. BRANDIS, Inspector-General of Forests, of Cinchona planting on the hills east of Toungoo, dated the 20th September 1880.

THE reasons why I do not advocate the establishment of any extensive cinchona plantations on account of Government on the hills east of Toungoo are : *first*, the long and trying, dry, hot season from February to May ; *second*, the difficulty of the labour question and of securing and maintaining in the feverish climate and in the, at present, somewhat inaccessible position of these hills, a competent superintendent, who will be content to work with the Karens.

The first difficulty can, in my opinion, to some extent be overcome by selecting moist and well-sheltered valleys. Unfortunately, I could not manage to go to Than-doung-gyee while at Toungoo in February last, but so much I know that the locality is on a dry slope, and not in a moist sheltered valley.

2. If Dr. King goes, he must, I am inclined to think, make up his mind to spend the better part of a season on this trip. What with the journey to Toungoo, and the examination of the hills on both sides of the Thonk-yay-gat valley, he will not be back in Calcutta under three months, and I am anxious clearly to state my opinion that a short and rapid visit will not enable him to form any practically useful conclusions on the subject.

3. I submit that Dr. King should be asked, not only to report on the results of the experiment made at Than-doung-gyee, and on the prospects of the ultimate success at that place, but that the object of his inquiries should be more comprehensive. The question is not so much to determine whether the conditions of climate and situation of Than-doung-gyee are or are not favourable to the production of cinchona, but whether, in Dr. King's opinion, the evil effects of the long, dry, and hot season can be sufficiently counterbalanced by the selection of a damp sheltered valley at a suitable elevation on these hills.

4. It will, in my opinion, be particularly important to obtain his views on the question whether *Cinchona Calisaya* is likely to succeed on these hills. In his report on the cinchona plantations in the Islands of Java, Dr. King draws attention to the fact that the cinchonas in South America are never found further north than 10° latitude north, nor further south than 20° latitude south, and suggests that favourable spots might yet be discovered in Burma. The climate of Java, however, where a most valuable variety of *Cinchona Calisaya* (called *ledge-riana*) thrives admirably, is very different from that of the hills east of Toungoo. For convenient reference, I extract the following account given in his report:—

The natural vegetation in these hills is very like that at a slightly lower elevation in Sikkim. The climate is, however, greatly different from that of Sikkim. At Tjiniruan (5,100 feet above the sea) the temperature at 6 A.M. all the year round ranges from 50° to 59° Fahrenheit, except during the two dry months, when it occasionally falls as low as 44° Fahrenheit. The highest temperature during the day is 73.5° Fahrenheit. The mean average over the whole year is 53.5° Fahrenheit, while the constant temperature of the soil at five feet from the surface stands all the year round at 64.04° Fahrenheit. The rainfall for the year varies at the different estates from 120 to 140 inches. The rainy season *par excellence* extends from November to June. Of the remaining four months, August and September are the driest. But there are very few days absolutely without a shower in the afternoon. The rain falls at all times very gently, and violent storms and floods are very rare. It is only during the

early part of the rainy season that rain falls during the early part of the day; at other times it falls chiefly in the afternoon. The climate is a remarkably even one, and the weather for the day can be predicted every morning from the temperature about sunrise. Experience at Tjiniroan (the chief Government plantation) has shown that, if the thermometer at 6 o' clock A.M. stands at or below 54° Fahrenheit, no rain will fall during the day. If it stands at 55° Fahrenheit, rain in the afternoon is probable; if at 57° Fahrenheit, rain in the afternoon is certain; while, if it stands at 60° Fahrenheit, rain will surely fall before noon.

5. The second obstacle to success can, without difficulty, be overcome if men are employed who have the proper tact and spirit, and who are determined to get on with the Karens. On both sides of the Thonk-yay-gat valley, there are large tracts of country densely inhabited, and, to a great extent, inhabited by Christian villages, where the people are only too glad to earn money if they are fairly well treated and managed with that consideration and sympathy which is due to people who have made some progress in morality and civilization. I do not know whether all forest officers, who have hitherto had charge of this business, have fully succeeded in gaining the confidence of the Karens. The Christian Karens on those hills have a strong spirit of independence, but they are amenable to reason, and they are easily managed. There would, in my opinion, be no difficulty in finding suitable localities high up in some of the side valleys of the Myitgnan valley on its *east* side (not on the west), where labour would be abundant. But these localities are difficult of access, being four to five days' march from Toungoo in the best season, and such an isolated existence would not be pleasant for the Superintendent of the Plantation.

There may be localities within less distance from Toungoo north of the Thonk-yay-gat river in the vicinity of Than-doung-gyee or Leike-to, but they will have to be searched out.

6. I am still strongly of opinion that the main object in maintaining the Government plantation must be to support the distribution of seeds and plants to the Karens. Mr. Ribbentrop, in his report of the 1st July last, says that all efforts to spread the cinchona cultivation amongst the population have failed. If any sustained efforts have been made in this direction, they do not seem to have become generally known. The Karens, in the extensive tract of country, traversed by me in February last, on my way from Toungoo up the Myitgnan valley to Lomatee, were entirely ignorant of its being the intention of Government to distribute seeds and plants.

7. At the high rate of wages in Burma it would be much too expensive to establish a large Government cinchona plantation without perfect certainty that the best quinine-yielding species will succeed. But a small plantation, with propagating houses, should be maintained, and such a plantation may

possibly be maintained at Than-doung-gyee. The object of this small plantation would be to determine whether any of the more valuable kinds can be grown successfully, and to distribute seeds and plants to the Karens. But I fully agree with Mr. Ribbentrop that even such a small experimental plantation will require a separate and competent Superintendent resident on the spot. Dr. King will be able to say whether a suggestion, which I made to him in writing on the subject in February last, can be carried out, to select one of the subordinates trained at the Sikkim plantations, and to send him to Toungoo.

8. It should be clearly understood that, as far as our present experience goes, it would not be expedient to establish a large cinchona plantation on account of Government, and much less to manufacture quinine or alkaloids; but that the aim should be to induce the Karens to plant the tree in clearings made in sheltered valleys in the forest or on the edge of it, above their toungyas and betel gardens, to use the bark as a febrifuge themselves, and perhaps eventually to export the bark to other districts of Burma and the adjoining countries.

Mr. Ribbentrop has made an excellent commencement in cultivating tea and coffee as an experiment. Dr. King's advice regarding this experiment also will be extremely valuable.

III. REVIEW.

Forest Reports of the Central Provinces, Berar, Coorg and Ajmere.

THE Review on the Annual Forest Report of the Central Provinces for 1879-80 has reached us. It reports that the area under fire protection has been largely extended, though protection was not always very successful, and that especially in the Banjar Forest protected since 1875, and Barela Forest protected since 1872, very large fires occurred. In our opinion the most interesting portions of Major Doveton's Report are those which record the improvement cuttings effected in several of the Reserves, and the system of raising bamboo from seed. The system of improvement cuttings is thus described by the Conservator :—

“Some years have now elapsed since improvement cuttings were first commenced. They began with the cutting over of badly grown teak with the view of replacing the inferior produce removed by straight poles of a greater value, but by degrees these operations have become more worthy of the designation assigned to them. During the past year, for instance, on 450 acres in Punassa, a complete cutting was made, in which everything that it was not desirable to reserve was cut and removed. Similarly 3,360 acres in Hoshangabad and Seoni were treated, though not on so perfect a system, the cutting being, except on a small area in Rajaborari, confined to the cutting back of badly grown teak and the removal of creepers, and obstructions to the existing crop of the more valuable species. In Ahiri also cuttings have been made with the view of increasing the production of teak.

“The regrowth from the cuttings of previous years has, with very trifling exceptions, made excellent progress, and the effect on the forest and the value of the growing stock is very satisfactory.”

The financial results of the year were as follows :—

Receipts	...	...	Rs. 8,52,862
Charges	...	...	„ 3,93,715

Surplus .. Rs. 4,59,147

The Berar Forest Report shows very little which requires any special notice. The chief point of notice, to which attention is given, is that of the damage done by frost to the planta-

tions, especially in Kinwat and Bairagarh, in the former of which nearly 700 acres were destroyed.

The financial results were :—

Receipts	...	...	Rs. 3,07,501
Charges	...	...	„ 1,10,207
			<hr/>
Surplus	...	Rs.	1,97,294

The Coorg Forest Report shows that the area of the forest has not yet been finally settled, but seems to amount to about 220 square miles. The chief noteworthy point is the stoppage of kumri cultivation in the Ghât forests.

The financial results were :—

Receipts	...	...	Rs. 1,01,786
Charges	...	...	„ 55,165
			<hr/>
Surplus	...	Rs.	46,621

The Ajmere Report shows that the area of Reserves now stands at 64,428 acres, or about 100 square miles, in which considerable progress has been made in protection and restocking. But the fires in 1879-80 were very bad, and the difficulty appears to be, as usual, the grazing. We are glad to see the remarks of the Government of India to the effect that “it is certainly better to encourage the cutting of grass as a mode of utilizing the large supply of cattle fodder which these protected areas are said to produce, than to permit the grazing of cattle. Every endeavour should be made to encourage the villagers to utilize this grass.”

The financial results of the year were :—

Receipts	...	...	Rs. 1,861
Charges	...	...	„ 18,750
			<hr/>
Deficit	...	Rs.	11,889

We hope shortly to receive the reports of the Punjab and North-Western Provinces, and so complete our notice of the results of 1879-80.

We are sorry to say that having mislaid one of the numbers of the “Journal of Forestry,” the usual review will be postponed till the April No.—ED.

JY. NOTES, QUERIES, AND EXTRACTS.

PAPER FROM CONIFEROUS TREES.—To make a pliable and merchantable paper from the bark of coniferous trees it is necessary to exhaust, or nearly exhaust, the intercellular or tannic substances therefrom, since, if they are retained, the paper produced will be harsh and hard, and will have a stiffness like parchment, such intercellular or tannic substances acting as a "size" to stiffen the paper, and if the stock is subjected to heat, it will become discolored and cannot be thoroughly bleached. It has also been found that to extract the intercellular or tannic substances it is necessary to treat the bark of coniferous trees with cold or tepid water, since, if treated with hot water or steam, the stock becomes discolored.

This process, therefore, consists in exhausting, or nearly exhausting, the intercellular or tannic substances from the bark of coniferous trees by treating the same with cold or tepid water; further, in a pulp made from the bark of coniferous trees having the intercellular or tannic substances exhausted, or nearly exhausted, therefrom; further, in the process of making paper pulp from the bark of coniferous trees, consisting in treating the bark with cold or tepid water, macerating such bark either before or after the treatment with cold or tepid water, and then bleaching the stock. The invention therefore consists in the paper, as a new article of manufacture, made from the barks of coniferous trees with the intercellular or tannic substances exhausted, or nearly exhausted, therefrom. This paper is very pliable and tough, light in color (if bleached,) and smooth and fine in texture. It can be readily distinguished by experts from the paper previously made from the bark of coniferous trees wherein the intercellular or tannic substances were retained as a size, as the last mentioned paper is stiff and harsh, presenting a different appearance to the eye, and a different feeling to the touch.

The bark of the coniferous trees preferably macerated by any of the ordinary methods, or taken from the trees without maceration, is put at once into the pulping engines, where it is beaten and thoroughly washed by passing through it a stream of cold or tepid water continuously. The coloring matter peculiar to this paper stock and to no other, which is highly soluble in water, is driven into the water and carried off by this operation, which should continue from four to ten hours. Gallo-tannic acid, one of the injurious constituents of this stock, decomposes and darkens at a temperature of 160°

Fahrenheit ; therefore the temperature of the water in the engines should never exceed that degree of heat, the best temperature being about 80° Fahrenheit. At the expiration of this operation the pulp is ready at once to be run into paper in the usual way.

If it is desired to lighten the color of the pulp it may be acidulated by some dilute acid, preferably sulphuric acid. This acid is then washed out, and the pulp then run into paper in the usual way. For very light colored and white papers the pulp should be treated to a solution of chlorinated alkali, preferably chlorinated soda, the strength of this solution depending on the degree of whiteness desired. It has been found in bleaching this stock that it is obstinate under treatment when chlorine alone is held in the water ; but as soon as the little soda or potash is thrown in, the stock begins to bleach at once. The slightest degree of strength of alkali in the solution improves the color of the pulp, and the greatest degree of strength does no injury.

By this treatment, in the first instance, of water of the temperature described, the color of the bark stock is lightened as the intercellular or coloring matter in the bark is washed out, thus avoiding the injurious effect of boiling, by which latter operation the color is set and the rosin fused, thus cementing the fibres together, and effecting the color of the pulp very badly. This species of bark, although easily bleached as a whole by the above-described method, is apt to retain clusters of fibres of the outer bark, which resist the process of bleaching, and appear as red hairs in a ground of white or very light paper. In order to treat such bark properly and completely, when a white or nearly white paper is wanted, the disfibred bark, after the treating and washing described, is boiled in lime water from four to sixteen hours, the time being regulated by the amount of lime used, which varies from one to four barrels to two tons of stock. After this boiling, the bleaching, if any is requisite, is performed as described.—(*Paper Maker's Journal.*)

USES FOR WASTE SAWDUST.—Until a few years ago the enormous "lumber" trade of North America took things pretty well as it liked, and so long as those engaged in the industry could find a location on the banks of a fair-sized stream, which was not very difficult in that well-watered country, they did not experience much trouble in conveying to the great centres of consumption all the timber they could cut. The river afforded, not only an easy means of conveying their produce to market, but abundant power for driving their saws, and also formed a convenient receptacle for the sawdust which they produced in enormous quantities. But various

interests found the presence of the sawdust a serious objection—notably the fishing industry ; and both in Canada and the United States the Legislature stepped in to prohibit the casting of sawdust into any running stream under heavy penalties. At the same time various causes—such as the competition of coal, the exhaustion of the forests closely adjacent to the river, and the consequent increase in cost of production and decrease in value—combined to reduce the profits of the lumberers, who thus found themselves under the necessity of getting rid of their refuse sawdust in some more costly manner than by merely casting it into the stream. The same duty is of course thrown on the owners of all saw mills ; and, as it is calculated that at Minneapolis alone the quantity of sawdust produced in a single season is equal to about 800,000 cords of solid timber, each “cord” being equal to 128 cubic feet, the rapid accumulation of the refuse material in different parts of the Continent may be better imagined than calculated. The “millers” are looking about for a profitable mode of utilising this product. Burning it as fuel for their steam-engines makes no appreciable diminution in the supply ; and, though various means of turning it to good account have been suggested, their adoption is not always practicable on the spot. Mixing the sawdust with tar or pitch, and converting it into fuel, has been found to answer in some cases ; in others the manufacture of “fire lighters,” by mixing the sawdust with petroleum or resin, and pressing into small cakes, has been adopted. An ingenious American inventor has devised a machine for working up the material into a pulp and compressing it into various shapes, such as barrels, brackets, doors, &c. It is said that articles of furniture made in this way are in certain respects preferable to those made of ordinary wood, the pulp becoming perfectly hard and impervious to water. It is not improbable, therefore, that—as has already happened in this country—the prohibition placed on the throwing of refuse into the streams may result in the establishment of new and profitable industries.—(*Paper Maker's Journal.*)

Query :—EUCALYPTI.—Have any experiments been made with the different species of Eucalypti to discover their floating powers?—RIVERINE.

READING a note by “P. K.” on the effects of staining oak wood by lime water reminds me of a very beautiful “teapoy” of “walnut” wood which had been stained perfectly black by the same method. The water must be applied with a fine brush, and allowed to dry perfectly before another coating is applied. French polish is then used in the usual way.—RIVERINE.

THE attention of the Russian authorities like that of the Bombay Government has lately been turned to the prejudicial manner in which certain districts have been affected by the wholesale destruction of trees. From the earliest ages, the vegetation in the valley of Samarcand, and generally of the districts of Saraf-jansk and Sagdiana, has been so luxuriant, and the climate so mild and pleasant, that it has been compared by Persian poets to paradise, and so fertile is the whole oasis, one of the largest in Central Asia, that it produces not only sufficient corn for the subsistence of its 30,000 inhabitants and of the 9,000 troops quartered in it, but is also able to export large quantities of rice and wheat every year to Bokhara. During the last ten years, however, the climate has become sensibly worse, and this deterioration is believed to be mainly attributable to the reckless way in which the forests have been cut down, and extensive tracts entirely denuded of trees, partly by the native inhabitants, who burn down whole woods in order to obtain charcoal easily, and partly by the Russians to procure the building material they required when they took possession of the territory. Energetic measures are, however, a correspondent of a German paper states, now being taken to arrest this wholesale destruction. The felling of trees for conversion into charcoal, or to float down the river to Bokhara, is strictly prohibited; and a decree has also been issued that a certain number of trees are to be planted on every acre of irrigated ground as well as on the banks of the streams and canals. In pursuance with this order no fewer than 11,750,000 young trees were, it is said, planted last spring, in the district of Samarcand.—*Indian Agriculturist*.

THE following are the only extracts from the Report of the Lucknow Horticultural Garden for 1879-80 of any interest to our readers :—

Carobs.—This year the carob trees bore a very light crop, only $3\frac{1}{4}$ seers of seed were obtained. The pods were much softer and sweeter than in previous years, owing, doubtless, to the mildness of the season and absence of hot winds when ripening.

Repeated attempts were made to raise plants by budding on seedling stocks; buds were inserted in different months, but I regret to say all failed: but for a limited number of stocks budding would have been tried all the year round. Grafting by inarching was also tried, but, like the budding, was unsuccessful. When a supply is ready fresh attempts will be made.

Eucalypti.—These call for no special notice. The plantation mentioned in previous reports continue to flourish. One tree of *E. citriodora* flowered, and a few seed capsules formed; it remains to be seen if mature seed will be developed.

As the name of *E. saligna* was not known when first noticed, specimens of it were submitted to Baron von Müller and Sir Joseph Hooker for identification. Both pronounced it to be *E. resinifera*. In a letter received from Baron von Müller last July, he writes :—"While working on my *Eucalyptus* atlas I find this species approaching rather to *E. robusta*, but there are characteristics to separate it from either, and I have temporarily named it *E. Kitormiana* in honor of its discoverer who found it at Illowarra, the *only locality in which it is known* in a wild state." Considering that it has already been distributed under two names, it seems undesirable to add a third, especially as it is only a temporary one; confusion is likely to result by so doing, which will be avoided by adhering to the present name.

RESIN AND TURPENTINE.—The following account of the mode of production of resin and turpentine on the south-eastern coast of the United States is taken from an American paper :—"From Wilmington, N. C., southward, and nearly all the way to Florida, the pitch pine trees, with their blazed sides, attract the attention of the traveller. The lands for long stretches are almost worthless, and the only industry, beyond small patches for corn or cotton, is the 'boxing' of the pitch pine trees for the gum, as it is called, and the manufacture of turpentine and resin. There are several kinds of pine trees, including the white, spruce, yellow Roumany, and pitch pine. The latter is the only valuable one for boxing, and differs a little from the yellow pine, with which it is sometimes confounded in the north. The owners of these pine lands generally lease the 'privilege' for the business, and receive about 125 dols. for a 'crop,' which consists of 10,000 'boxes.' The boxes are cavities cut into the tree near the ground in such a way as to hold about a quart, and from one to four boxes are cut in each tree, the number depending upon its size. One man can attend to and gather the crop of 10,000 boxes during the season, which lasts from March to September. About three quarts of pitch or gum is the average production of each box, but to secure this amount, the bark of the tree above the box must be hacked away a little every fortnight. Doing this so often, and for successive seasons, removes the bark as high as can be easily reached, while the quality of the gum constantly decreases, in that it yields less spirit, as the turpentine is called, and then the trees are abandoned. The gum is scraped out of the boxes with a sort of wooden spoon, and at the close of the season, after the pitch on the exposed surface of the tree has become hard, it is removed by scraping, and is only good for resin as it produces no spirits. The gum sells for 1.50 dollars a barrel to the distillers. From 16 barrels

of the crude gum, which is about the average capacity of the stills, 80 gallons of turpentine and 10 barrels of resin are made. The resin sells for from 1.40 dols. to 5 dols. per harrel according to quality, and about pays for cost of gum and distilling, leaving the spirit, which sells for 40 cents. a gallon, as the profit of the business. Immense quantities of resin await shipment at the stations along the line, and the pleasant odour enters the car windows as we are whirled along. After the trees are unfit for further boxing, and are not suitable for lumber, they are sometimes used to manufacture tar, but the business is not very profitable, and is only done by large companies, who can thus use their surplus labour. The trees are cut up into wood, which is piled in a hole in the ground and covered with earth, and then burned in the same way as charcoal is burned elsewhere. The heat sweats out the gum, which, uniting with the smoke, runs off through a spout provided for the purpose. A cord of wood will make two barrels of tar, which sells for 1.50 dols. per barrel, and costs $37\frac{1}{2}$ cents. to make. The charcoal is then sold for cooking purposes."—*Indian Agriculturist*.

TIMBER OF BRITISH GUIANA.—A meeting of the Royal Geographical Society was held recently in the theatre of the University of London, Burlington Gardens, the Earl of Northbrook, First Lord of the Admiralty, occupying the chair.

Mr. Everard F. im Thurn read a paper describing an expedition which he made into the interior of British Guiana in 1878. He explained that during the last three years he had been superintending the museum at Georgetown, more commonly called Demerara. Collecting for the establishment, he had made several journeys into the interior of the country. The country might be said to consist of four tracts, lying one beyond the other parallel to the coast. Of these only the outermost, the sugar land, was at present cultivated and inhabited to any considerable extent. Next came the timber tract, which was merely inhabited by a few Negroes and Indians. It once contained much valuable timber, which was readily brought to market, but that had now been felled and destroyed, and it was no longer easy to find any spot where it would be worth while to set up the large and expensive plant necessary for remunerative timber cutting, so that, unless the forests were allowed to recover, the timber trade of the colony must ere long come to an end. The forest tract immediately succeeded the timber tract, and was uninhabited except by a few widely-scattered Indians of four or five different tribes. It was everywhere covered by dense forests, as yet untouched by the woodcutter, and consisted largely of the two most valuable trees of the colony—the green heart and the mora. The

last tract was formed by the savannahs of the interior, which must be distinguished from the so-called savannahs of the coast and forest regions. Our share of this huge meadow was about 1,400 square miles in extent.

THE EXTINCTION OF THE PINE.—In no way, says the *Boston Transcript*, have the wasteful habits of Americans been more conspicuously shown than in their utter disregard of all economy in utilizing the rich stores of pine timber which our virgin forests afforded. We say afforded advisedly, for such has been the utter recklessness with which these have been felled and destroyed that, compared with the needs of the country, the white pine within hauling distance of the rivers of New England has very largely disappeared, and if, back from the streams, large and valuable trees of this variety are still found standing, they are marked for an early attack of the wood-man's axe, for white pine of good quality no longer ranks among cheap woods, but pays a handsome profit to the lumberman over and above a very considerable outlay for handling and hauling. On the other hand, on account of the ease with which it can be worked, its regularity and straightness of grain, its lightness, and its peculiar adaptability to thousands of purposes, white pine comes daily into greater and greater demand, and it is one of the serious problems with which the near future must deal to know how to find the needed supply. It is very certain that at the present rate of waste and consumption the supply of available white pine lumber will in a few years be nearly exhausted, and that if steps are not taken to create a new supply, and that speedily, a lumber famine will be upon us. Of hard pine the south, especially Florida and the Carolinas, have an ample store, more than will suffice, even if cut in the present wasteful way, for generations to come; but white pine, which, were it not that it has been so common in the past in New England, we should prize as one of the most valuable woods, is daily becoming more and more scarce, and he who is fortunate enough to possess a tract of pine land, even though of limited extent, may well feel that he has a "bonanza," with the value actually in sight and available, and without any of the uncertainties that attach to properties classed as "mining," where the ore can be counted upon only as far as it can be seen, and may "pinch out" most unexpectedly at any moment. Over the waste that has already occurred, over the millions upon millions of feet that have been allowed to decay or to succumb before forest fires, it is useless to indulge in regrets, but it does seem as though those engaged in the lumber business would find it for their interest to introduce more economic methods of husbanding what remains, and

of securing the largest possible yield in "board feet" from each tree hereafter.

"It so falls out
That what we have we prize not to the worth
While we enjoy it; but being lack'd and lost,
Why then we rack the value."

And so it is with our New England pine. We have seen it about us from boyhood up; we have whittled it and wasted it; we have used it for kindling, and enjoyed the sharp, quick crackle of its blaze; we have used it for all sorts of purposes, but we have never realized either its beauty or its superior advantages as lumber.

We wisely appoint and maintain at the public expense a fish commission to apply the teachings of science and experience to the re-stocking of our rivers and ponds, and establish and execute stringent laws for the protection of the small fry until they are old enough and numerous enough to protect themselves from extermination. In some such way something might and should be done to protect our forests, especially those of white pine. The great trees that have attained their maturity may well be felled, but those younger in years and of a smaller growth should be protected from the vandal hands that ruthlessly lay them low for the purpose of "clearing up," and in the end this protection would be found to pay an hundredfold. Moreover, forestry has made its advances along with the other sciences, and it is believed that plantations of young pine trees, set out in proper soil and surrounded with proper conditions, would, in time, return a handsome yield to the investor who can afford to wait for it. In the west a bounty, generally in the form of land from the public domain, is given to those who set out trees. There is no public land in New England to be bestowed in this way, but if the pine-growing states in this corner of the country would institute experiments, and provide the means for the necessary tests, we believe that farmers and others could be made to see that it would be for their ultimate advantage, not only sacredly to preserve every growing pine tree on their lands, but to set out young trees—a few every year. They might not live to see them mature, but they could leave no better inheritance to their children, none that would make a handsomer return upon the investment, than a grove of vigorous and rapidly-growing pines. There are thousands of acres in Massachusetts, now practically valueless, that might profitably be applied to this purpose, and in New Hampshire and Maine whole townships, which have been robbed of their pine, and now yield no return whatever to their owners, might, by gradual planting, at a cost comparatively small, be turned into rich and ever-increasing deposits of wealth, upon which future generations might and would make liberal drafts. We are mining and "preparing"

our anthracite in a way so wasteful and at a rate so rapid that in a score of years this great staple fuel is likely to be scarce and high, with no possibility of renewing the supply. An equally extravagant waste and equally rapid production are destroying our pine lumber. But in this case renewal is possible, and it behoves us to see to it that this important element of future prosperity is not neglected. And the time to move in the matter is now.—*Timber Trades' Journal*.

THE following extract is from the Report on the Inland Trade of British Burma for 1879-80, published in the *British Burma Gazette* for October 23rd, 1880:—

The value of the timber imported during the year by the Irrawaddy was only £9,575, compared with £23,063 in 1878-79. This decrease affords strong evidence of the exhaustion of the more accessible teak tracts. The river rose to an extraordinary height during the rains, and if there had been more timber to float out, the facilities for doing so were unusually good. An unhealthy season, with sickness amongst the foresters, and the want of elephants, also contributed to the smallness of the out-turn. The Toungoo timber trade, which is much more extensive than that on the Irrawaddy, also fell off very seriously, the value of the imports having been £99,612 only, as against £196,852 in the previous year, when, however, a great quantity of inferior timber was floated down. Endeavours have been made to find out the condition of the King's forests beyond Toungoo, but no satisfactory information has yet been obtained.

GUTTA-PERCHA:—To the Editor of the *Ceylon Times*. Extracted from the *Indian Agriculturist*. Sir,—Some time since a letter appeared in your journal on the subject of gutta-percha. As I have also taken some interest in this product, I am now enabled to send you the following few remarks on its cultivation, &c. The gutta taban, or tuban trees, are found in Sumatra, Johore, Java, Borneo, and in Singapore, extending over a tract of country from 6° to 10° N. lat. to 10° S. lat., and from 100° to 120° E. long.

The tree (tuban) has a straight stem from 60 to 30 feet, growing to a height of 100 to 120 feet, and when fully grown is from 2 to 3 feet in diameter. The wood of the tree is soft, fibrous, and spongy, of a pale yellow, and marked by black lines consisting of reservoirs filled with the gum. The yield of a large and full-grown tree is sometimes 23 cattys or 17½ lbs. It is generally estimated that 10 full-grown trees will yield 1 picul of gutta-percha or 133½ lbs. The pure gutta-percha is worth some 2s. 6d. to 3s. 6d. per lb. The old and destructive method of collection was to fell the tree and to ring

it with an axe at intervals of 3 to 18 inches, the milk being collected in cocoanut husks, &c., and boiled to draw off the water. The soil most suited to the gutta taban is precisely such as we have in Ceylon; the tree thrives well on naturally well drained hill-sides and in a free soil, and at a considerable elevation. The great drawback to its cultivation is, that it is a very slow grower, taking nearly thirty years to arrive at its full growth, when it is about three feet in circumference, at a height of three feet from the ground. The seeds readily germinate, and the best method of putting out the plant is in bamboo pots, as the tap-root is long, and impatient of any injury. Gutta-percha is entirely distinct from caoutchouc. It reaches the English market from the Straits in three different preparations; the first being boiled milk, of pink color, hard and tough and mixed with bark and other natural impurity; the second, gutta-muntah, being a preparation of gutta reboiled up with cocoanut oil and inferior juices (such as that of the mudar tree, which grows commonly in Ceylon); and the third is the crude gutta-percha, being simply the milk, hardened without any process whatever. The gutta-percha of commerce consists of pure gutta and 15 per cent. of a soft resin mixed with it—the resin has the simple chemical action of absorbing oxygen, without which property, light, such as the sun's rays, would render the gutta brittle, friable, and resinous; it is known that in submarine cables line gutta-percha does not sensibly decay, being protected from the light.—*Pioneer*.

FOREST-SAVING IN AMERICA.—A good deal has been written in our columns about the depletion of the forests of the North American continent; and, though in the sense of a supply of timber for the purposes of trade running short we do not believe that the present generation will witness anything approaching that consummation, we are none the less conscious that the process of destruction is in our day carried on with needless prodigality. We are, therefore, glad to learn that the American Association for the Advancement of Science is about to take steps for preserving the forests in the United States, and for the protection from waste of timber generally. A committee has been appointed for the purpose of promoting these objects. The attention of Congress and State Legislatures is to be called to the great and increasing importance of providing by adequate legislation for the protection of the existing woodlands of the country against needless waste, and for the encouragement of measures tending to a more economical use and proper maintenance of the timber supply, it being evident that the forests of the country are being used and wasted in a much greater degree than their restoration by natural growth. The committee, in a report they have just presented to the Association,

recommend the enactment of a law to protect trees planted along highways, and to encourage such plantings by deductions from highway taxes; also the passage of a law that shall exempt from taxation the increased value of land arising from the planting of trees where none were growing, for such period as may appear proper, or until some profit may be realized from plantation; by appropriations of money to agricultural and horticultural societies, to be applied as premiums for their planting, and for prizes for the best essays and reports upon subjects of practical forest culture; by encouraging educational institutions to introduce courses of instruction having reference to practical silviculture; by laws tending to prevent forest fires; by imposing penalties against wilful or careless lighting of such fires, and enlarging and defining the powers of local officers in calling for assistance and in adopting measures for suppressing them; by establishing under favourable circumstances model plantations; by the appointment of a Commission of Forestry under State authority, analogous to the Commission of Fisheries.

Whether this praiseworthy effort of the Association will meet with the encouragement it deserves from the legislative authorities and secure the ends it aims at, remains to be seen. Great bodies move slowly, and many projects of this kind have been urged on Congress before, but we never heard that anything came of them.

PRESERVING TIMBER IN THE GROUND.—In speaking of the well-known methods of preserving posts and wood which are partly embedded in the earth, by charring and coating with tar, it is said these methods are only effective when both are applied. Should the poles only be charred without the subsequent treatment with tar, the charcoal formation on the surface would only act as an absorber of the moisture, and, if anything, only hasten the decay. By applying a coating of tar without previously charring, the tar would only form a casing about the wood, nor would it penetrate to the depth which the absorbing properties of the charcoal surface would insure. Wood that is exposed to the action of water or let into the ground should first be charred, and then, before it has entirely cooled, be treated with tar till the wood is thoroughly impregnated. The acetic acid and oils contained in the tar are evaporated by the heat, and only the resin left behind, which penetrates the pores of the wood and forms an airtight and waterproof envelope. It is important to impregnate the poles a little above the line of exposure, for here it is that the action of decay affects the wood first, and where the break always occurs when removed from the earth or strained in testing.—*Mechanic.*

THE October number of the *Revue des Eaux et Forêts* announces the retirement of both M. Nanquette, the Director, and M. Mathieu, the Professor of Natural History at the Forest School of Nancy. M. Nanquette will be succeeded as Director by M. Puton, whom many of us knew as the Professor or Assistant Professor of Forest Law, and who is besides well known for his writings on 'Aménagement.' The successor of M. Mathieu has not yet been appointed; we presume it will be M. Fliche.

MONUMENT TO FOREST DIRECTOR BURCKHARDT.—We have received a Circular, signed by several eminent Forest Officers and other friends of the late Dr. Burckhardt, saying that a committee has been formed at Hanover for the purpose of erecting in a forest near that town a monument to commemorate the life and work of a man who was distinguished both as a forester and as an administrator. Contributions will be received by Forest Minister Kraft in Hanover.—D. B.

WE are sorry to say that the author not having sent us in time the manuscript of the second portion of his paper on Frosts and Forests, we must defer completing it till our next issue.

Y. TIMBER MARKET.

The following have been the prices of Teak and the stock in hand at the Public Docks in London during the last quarter of 1880, compared with the corresponding period of former years :—

		Prices.			
		1879.		1880.	
		£ s. to	£ s.	£ s. to	£ s.
1st October	...	8 10	„ 10 10	13 10	„ 14 10
1st November	...	9 0	„ 10 15	13 10	„ 14 10
1st December	...	12 0	„ 13 0	13 10	„ 14 10

Stock at the Public Docks in loads of 50 cubic feet.

1st October	...	11,900	8,200	3,400
1st November	...	11,900	7,400	3,200
1st December	...	10,100	6,200	2,600

The figures are taken from Messrs. Churchill and Sim's Monthly Circulars. The great rise in prices and the reduction in the quantity of timber in stock are remarkable.

D. B.

YJ. EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA—

No. 646F.—*The 8th October 1880.*—*Mr. W. B. Fisher, B.A.*, Assistant Conservator of Forests of the 1st Grade in Assam, is appointed to officiate as a Conservator of Forests of the 4th Grade in that province, in addition to his own duties, during the absence on privilege leave of *Mr. G. Mann*.

No. 688F.—*The 22nd October 1880.*—The Notifications of this Department, No. 99F., dated the 13th February, and No. 159F., dated the 4th March last, promoting *Mr. M. H. Ferrars, B.A.*, from the 3rd to the 2nd Grade of Deputy Conservators of Forests in British Burma, and directing the reversion of *Mr. P. J. Carter* to his substantive appointment of Assistant Conservator of Forests of the 1st Grade in that province, are cancelled.

No. 708F.—*The 29th October 1880.*—*Mr. H. Leeds*, Deputy Conservator of Forests of the 1st Grade, now on leave, is transferred from the Central Provinces to the Punjab.

No. 748F.—*The 12th November 1880.*—*Mr. E. L. Heinig* is appointed to officiate as a Sub-Assistant Conservator of Forests, with effect from the 23rd October 1880, the date on which he joined his appointment.

Mr. Heinig is posted to Bengal.

2 —CALCUTTA GAZETTE.—

The 29th September 1880.—*Mr. W. M. Green* is promoted to the 2nd Grade of Assistant Conservators of Forests with effect from the 12th June 1880, the date of his confirmation in the 3rd Grade of Assistant Conservators.

The 5th October 1880.—The leave for three months granted to *Mr. E. Fuchs*, Assistant Conservator of Forests in charge of the Teesta Division, under para. 22 of the Forest Department Code will have effect from the 13th and not from the 1st July 1880, as previously notified.

The 12th October.—*Mr. H. H. Davis*, and *Mr. J. S. Gamble*, Assistant Conservators of Forests of the 1st Grade, are promoted to the 3rd Grade of Deputy Conservators from 5th July 1880. *Mr. Gamble* will continue to act, until further orders, as Conservator of Forests.

The services of *Mr. W. Jacob*, Deputy Conservator of Forests of the 2nd Grade, now on furlough, are placed at the disposal of the Chief Commissioner of the Central Provinces, from the date of his return from furlough.

The services of *Mr. J. C. MacDonell*, Deputy Conservator of Forests of the 3rd Grade, in charge of the Darjeeling Division, are placed at the disposal of the Punjab Government.

Mr. H. H. Davis, Deputy Conservator of Forests, is appointed, until further orders, to have charge of the Darjeeling Division.

The 22nd October 1880.—Under the provisions of Rule III of the Rules of the 28th July 1879, made under Section 25 (i) of the Indian Forest Act (Act VII of 1878), the Lieutenant-Governor is pleased to sanction the closing of the reserved forests of the Darjeeling Terai and lower hills, as well as those of the Julpigori district against hunting, shooting, or fishing, from the 1st December 1880 to the 1st June 1881.

The 26th October 1880.—**Mr. R. S. Dodsworth**, Deputy Conservator of Forests of the 3rd Grade, is appointed until further orders to have charge of the Chittagong Division. **Mr. E. G. Ohester**, Assistant Conservator of Forests of the 1st Grade, in charge of the Chittagong Division, is transferred to the Teesta Division. **Mr. E. Fuchs**, Assistant Conservator of Forests of the 2nd Grade, in charge of the Teesta Division, is transferred to the Hazaribagh Division.

Notification.—*The 23rd October 1880.*—The following rules passed by the Lieutenant-Governor, under section 75 (b), of the Indian Forest Act VII of 1878, are hereby published for general information:—

Rules for the Grant of Rewards to Government Officers and others in cases under the Indian Forest Act.

All non-gazetted Government Officers, and persons not in the employ of Government, are eligible for rewards under these rules.

2. Any Magistrate convicting an offender of any Forest offence, or directing the confiscation of any property under section 56 of the Act, may grant, in such proportion as he thinks fit, to any person or persons who have contributed to the seizure of the property or the conviction of the offender, a reward not exceeding the value of the property confiscated, plus the amount of any fine imposed.

3. The Forest Officer prosecuting the case may, if no reward is granted by the Magistrate, apply to the Magistrate for orders regarding the distribution of fines, and the value of forfeitures. In the event of the Magistrate's refusal, reference may be made by the Conservator of Forests to the local Government.

4. Rewards granted under these rules shall be disbursed at once, if they are less than Rs. 100. If they are over Rs. 100, that sum only will be disbursed at once, and the rest after the period of appeal has expired, or the appeal has been rejected. In the event of the conviction being reversed on appeal, the amount paid in rewards shall not be recovered from the persons to whom it has been paid, unless it shall appear that they have acted fraudulently.

5. In cases where, under section 67 of the Indian Forest Act, a Forest officer has accepted a sum of money as compensation for any damage which has been committed, the Conservator of Forests may authorize the payment of a portion of the amount realised as a reward to any person who may have contributed to the discovery of the offender.

The 30th October 1880.—Under Clause (a), section 29, Act VII of 1878, the Lieutenant-Governor is pleased to declare that from the 1st November 1880, trees of the undermentioned classes in the protected forests of the

Government Estate of Khoorda, in the district of Puri, shall be reserved; that is to say, sál, peasál, sisu, kendn (ebony), kurum, anam, teak, gambhari, tinia, kongora, asan, kasi, mahanim, and chhuriana.

The 17th November 1880.—In exercise of the power conferred by section 19 of the Indian Forest Act, 1878, the Lieutenant-Governor hereby declares the lands described in the Schedule hereto annexed to be a reserved forest from the 1st December 1880.

Descriptions of Boundary.

DISTRICT—Chittagong Hill Tracts. Name of Forest, Matamori Reserve.

North.—A demarcated line laid down from the ridge of Marang-atong down a spur, across the Matamori river at old Rajhonpara and up a spur to the water parting between the Twinekheong and Matamori rivers.

East.—The water parting between the Twinekheong and Matamori rivers as far as the source of the former, thence the water parting between the Sungoo and Matamori rivers as far as the source of the latter.

South and West.—The water parting between the Matamori on the one side and Arrakan and the are a drained by the Bagkhally river on the other, as far as the demarcated line forming the north boundary.

This reserve was notified under section 4 of the Forest Act in the *Calcutta Gazette* of 29th May 1878, and includes the area notified as the Matamori reserve under section 34 in the *Calcutta Gazette* of 23rd January 1879.

Notification.—*The 11th December 1880.*—The following rules passed by the Lieutenant-Governor of Bengal, under section 75 (d) of the Indian Forest Act VII of 1878, are hereby published for general information. These rules apply to the districts of Darjeeling and Julpigori, and will hold good during the season in which fires may be expected to occur from the 1st November in one year to the 1st June in the next :—

1. Any person living in the vicinity of a Government Forest Reserve, or occupying or using land in such vicinity, and desirous of cleaning by fire any standing forest or grass land near that reserve in a locality from which such fire would be likely to endanger the reserve shall observe the following rules :—

- (1.) He shall give notice of at least one week to the nearest Forest officer, ranger or forester, of his intention.
- (2.) He shall clear a belt of land at least 20 feet broad on the side of the land he proposes to burn, nearest to the forest Reserve.
- (3.) He shall choose for such burning a day or time when a high wind is not blowing.
- (4.) He shall light the fire in a direction contrary to the prevailing wind.

2. Any such person desirous of burning on land adjoining a Forest Reserve, wood grass or weeds, or other cut material, shall collect that material into heaps, and burn it separately in such a way that the fire may not endanger the forest reserve.

3. Any person collecting inflammable forest produce, such as grass and bamboos, on land adjoining a forest reserve, and any holder of a permit to collect such materials from the forest reserve, shall stack the material so collected in an open space as far removed as possible, from the forest.

4. All persons travelling on roads, passing through or along the boundary of a forest reserve, shall camp only at such places as may be cleared and set apart for the purpose of camping grounds by the Forest Officer, who shall yearly publish a list of such grounds in the vicinity of the reserve. Camping at other localities than those so set apart is forbidden; and all persons so camping shall light any fires they may make for cooking, or other purposes in such a way as not to endanger the forest reserve or the buildings or property on the camping ground; and they shall extinguish all such fires before leaving the camping ground.

5. The carriage of burning wood, firebrands or torches, through or along the boundary of any reserved forest, is prohibited.

3.—GAZETTE OF N. W. PROVINCES AND OUDH—

No. 979.—*The 20th October 1880.*—*Mr. E. P. Donsey*, Assistant Conservator, Valuation Surveys, privilege leave for two months from the 1st November 1880.

No. 960.—*The 16th October 1880.*—The services of *Mr. E. S. Dodsworth*, Deputy Conservator, and of *Mr. A. B. Grant*, Assistant Conservator, are placed at the disposal of the Government of Bengal.

No. 1087.—*The 13th November 1880.*—In continuation of Notification No. 755, dated the 14th July 1880, it is hereby notified that the Assistant Conservator in charge of the Ganges Division, Central Circle, took over charge of the Chandi Forests from the Superintendent, Roorkee Workshops, on the 1st November 1880.

No. 1004.—*The 2nd November 1880.*—Under section 41, Act VII. of 1878 (the Indian Forest Act), the Lieutenant-Governor of the North-Western Provinces and Chief Commissioner of Oudh has made, and with the sanction of the Governor-General in Council is pleased to publish, the following rules for the reserved and protected forests in the North-Western Provinces and Oudh :—

1. All words used in these rules and defined in Act VII. of 1878 (the Indian Forest Act) shall be deemed to have the meaning respectively attributed to them by the said Act.

2. *I.—Transport by land.*—The Conservator of Forests may establish depôts within the limits of, or on the boundaries of, any reserved or protected forest for the examination of timber and other forest produce in transit through or out of such forest, and for the collection of dues on such timber or produce: Provided that the name and situation of each depôt, and the route on which it is situated, is notified in every town and village in the neighbourhood of such depôt.

3. No timber or other forest produce shall be moved through or out of any such forest on any route on which a depôt has been established, unless covered by a pass issued by the Forest Officer, or by the owner of the forest, as the case may be. Such pass shall specify the kind and quantity of timber or other forest produce, the marks it bears (if any), and the place it came from; and shall be legibly signed or stamped by the Forest Officer, or, when such timber or produce comes from a private forest, by the owner of such forest.

Prohibition against moving timber, &c., except by defined routes.

4. The moving of any timber or other forest produce through or out of any reserved or protected forest, except by routes on which depôts have been established under Rule 1, is prohibited.

Officers who may sanction exemptions.

5. Within the limits of their respective charges, the Conservator of Forests, the Collector of Bijpur, the Deputy Commissioner of Lalitpur, and, when in charge of forest divisions, Deputy Conservators, Assistant Conservators, and Sub-Assistant Conservators, may exempt the inhabitants of any locality, or any class of timber or other forest produce from the operation of Rules 3 and 4.

Launching and collection of timber.

6. *II.—Transport by river.*—No person having launched his timber, or set it afloat on any river, shall collect the same, except—

(a.) With the permission in writing of the Forest Officer in charge of the forest division.

(b.) At places which such officer shall notify as catching depôts.

Pass for rafting timber.

7. No person shall raft or otherwise convey any timber which has been collected on any river without first obtaining a pass from the Forest Officer in charge of the forest division in which the river is situated, or from such subordinate officer as the officer in charge of the forest division may authorise on that behalf. Such pass shall show the number of logs or pieces, the kind of timber, the marks indicative of the owner's property therein, the place of its destination, and the time for which it shall remain in force. It may specify that the timber may be stopped at certain places to be named in the pass.

8. No pass shall be issued for any unmarked timber, or for such timber as bears a mark not registered as herein-after provided: Provided that when any person, having timber in transit on a river at the date of the publication of these rules, applies for a pass for such timber within six months from such date, such pass may be granted, although the marks on such timber have not been registered.

Detention of timber in default of production of pass.

9. Any Forest Officer may require any person, rafting or conveying timber as aforesaid, to produce the pass for the same at any time. No person shall be entitled to raft or convey timber by virtue of a pass which he does not himself hold, but which is, or is stated to be, in the hands of some other person. In the event of the pass not being produced, the Forest Officer may detain the timber.

10. For issue of the pass a fee not exceeding one anna for each log or piece of timber may be levied on such river, and at such places, as the Conservator of Forests may, from time to time, direct.

Fee for issue of pass.

Registration of timber, property marks.

11. All persons wishing to float or otherwise convey timber by any river shall register, at the office of the forest division to which the control of the river pertains, the mark which indicates their proprietary right in such timber. A fee of Rs. 5 shall be payable for such registration. No more than one mark shall be registered for each owner.

Refusal of registration of marks similar to those already in use, either by Government or another person.

12. No person shall be allowed to register a mark already registered in favor of another person, nor any mark used by Government; and the Forest Officer may refuse the registration of any mark which in his judgment so closely resembles a mark used by Government or registered in favor of any person, as to be easily producible by altering such marks.

Registration to hold good for three years. 13. Every registration under these rules shall hold good for three years, following the 1st of January next, after the date of registration.

A certificate showing the mark registered, the date of registration, the period for which it holds good, and acknowledging the payment of the fee, shall be given to every person registering his mark.

14. Within the limits of any area notified under section 45, the converting, cutting, burning, concealing, or marking of timber, the altering or effacing of any marks on the same, and the possession or carrying of marking hammers or other implements used for the marking of timber, except with the permission in writing of the Forest Officer, is prohibited. Such permission, if granted, shall specify the place at which only it is to take effect, and may contain such other conditions regarding the previous inspection of the timber, and otherwise as may be necessary.

15. *III.—General.*—Any person who infringes any of these rules shall be liable to imprisonment of either description for a term which may extend to six months, or to fine which may extend to five hundred rupees, or to both.

No. 1112.—*The 18th December 1880.*—*Mr. E. McA. Moir*, Assistant Conservator, 1st Grade, to be Deputy Conservator, 3rd Grade, with effect from the 2nd November 1880.

No. 1119.—*The 14th December 1880.*—*Mr. R. J. P. Pinder*, Sub-Assistant Conservator of Forests, having reported his return to duty on the forenoon of the 25th November 1880, the unexpired portion of his leave is hereby cancelled.

No. 1133.—*The 18th December 1880.*—In supercession of this department Notification No. 910, dated the 15th September 1880, *Mr. R. S. Dodsworth* reported his return to duty on the 30th August 1880, from the leave granted him in Notification No. 313, dated the 8th April 1879, and assumed charge of the Kheri Division on the forenoon of the 2nd September 1880.

No. 1141.—*The 22nd December 1880.*—*Mr. E. McA. Moir*, Deputy Conservator, 3rd Grade, reported his return from furlough on the 23rd November 1880, and is placed in charge of the Tons Forest Division.

No. 1160.—*The 31st December 1880.*—*Mr. O. Greig*, Assistant Conservator, 2nd Grade, to Assistant Conservator, 1st Grade, with effect from the 5th November 1880.

4.—PUNJAB GAZETTE—

No. 403F.—*The 8th October 1880.*—*Mr. C. F. Elliott*, Officiating Deputy Conservator of Forests, 3rd Grade, is confirmed in his appointment.

No. 407F.—*Mr. L. G. Smith*, Sub-Assistant Conservator of Forests, attached to the office of the Conservator of Forests, Punjab, is transferred to the Beas Division, which he joined on the forenoon of the 1st September 1880.

No. 432F.—*The 27th October 1880.*—*Mr. A. M. Reuther*, Assistant Conservator of Forests, 3rd Grade, is promoted to the 2nd Grade, with effect from the 14th September 1880.

No. 437F.—*The 28th October 1880.*—The services of *Mr. B. H. B. Powell, O.S.*, are placed at the disposal of the Government of India in the Home, Revenue and Agricultural Department, for employment on special duty in Madras, with effect from the 1st November 1880, or such date as he may be relieved of the charge of the Umballa Division by *Mr. J. W. Macnabb* on return from furlough.

No. 441.—*The 29th October 1880.*—*Mr. E. Sparling*, Deputy Conservator of Forests, Fuel Reserve, North Division, has obtained leave of absence on medical certificate for one month and twelve days, with effect from the afternoon of the 18th September 1880.

No. 442.—*Mr. J. S. Mackay*, Assistant Conservator of Forests, Gujranwala Division, is appointed temporarily to the charge of the Fuel Reserve, North Division, *vice Mr. E. Sparling*.

No. 447.—*The 30th October 1880.*—In continuation of *Punjab Government Gazette* Notification No. 41F., dated 20th January 1879, the Hon'ble the Lieutenant-Governor is pleased, in exercise of the authority vested in him by section 16 of the Indian Forest Act, 1878, to appoint the Settlement Commissioner of the Punjab, for the time being, to hear appeals from the orders of the Forest Settlement Officer of the Jhelum and Shahpur Districts.

No. 468F.—*The 20th November 1880.*—*Mr. J. C. McDonell*, Deputy Conservator of Forests, transferred from Bengal to the Punjab, is attached temporarily to the office of the Conservator of Forests, Punjab, with effect from the forenoon of the 11th November 1880.

No. 472F.—*The 23rd November 1880.*—*Mr. A. M. Reuther*, Assistant Conservator of Forests was, on being relieved of the charge of the Fuel Reserve, South Division, appointed to the charge of the Fuel Reserve, North Division, with effect from the forenoon of the 21st October 1880, *vice Mr. J. S. Mackay*, Assistant Conservator of Forests, who rejoined the Gujranwala Division on the same date.

No. 474F.—*Mr. W. Shakespear*, Assistant Conservator of Forests, resumed charge of the Fuel Reserve, South Division, on the forenoon of the 14th October 1880, on return from the privilege leave of absence granted to him in *Punjab Government Gazette* Notification No. 818F., dated 10th August 1880, relieving *Mr. A. M. Reuther*.

No. 476F.—*Mr. F. D'A. Vincent*, Assistant Conservator of Forests, resumed charge of the Plantation Division on the forenoon of the 23rd October 1880, on return

from the leave granted to him in *Punjab Government Gazette* Notification No. 266F., dated 5th July 1880, relieving *Mr. E. A. Down*.

No. 481F.—*The 24th November 1880*.—In continuation of *Punjab Government Gazette* Notification No. 372F., dated 9th September 1880, the undermentioned Officer has been granted a further extension of leave by Her Majesty's Secretary of State for India, as advised in list dated 15th October 1880.

NAME.	Service.	Appointment.	Period and nature of extension.
Mr. W. Rhye 	Uncovenanted.	Assistant Conservator of Forests, 1st Grade.	Three months—sick certificate.

No. 499F.—*The 7th December 1880*.—*Mr. E. Sparling*, Deputy Conservator of Forests, is, on the expiration of the leave on medical certificate, granted to him in *Punjab Government Gazette* Notification No. 441F., dated 29th October 1880, posted temporarily to the Ravi Division, which he joined on the 1st November 1880.

No. 501F.—In supercession of *Punjab Government Gazette* Notification No. 403F., dated 8th October 1880, *Mr. C. F. Elliot*, Officiating Deputy Conservator of Forests, Punjab, is confirmed in his appointment, with effect from the 30th July 1880, *vice Mr. A. Pengelly*, deceased.

No. 527F.—*The 23rd December 1880*.—*Mr. H. Leeds*, Deputy Conservator of Forests, transferred from the Central Provinces to the Punjab, reported his arrival at Lahore on the forenoon of the 8th December 1880.

No. 538F.—*Mr. H. Leeds*, Deputy Conservator of Forests, is attached to the office of the Conservator of Forests, Punjab.

Mr. Leeds assumed charge of his duties on the forenoon of the 14th December 1880, relieving *Mr. J. C. McDonell*, Deputy Conservator of Forests.

5.—CENTRAL PROVINCES GAZETTE—

No. 3702.—*The 9th October 1880*.—The Chief Commissioner is pleased to invest *Mr. H. Moore*, Assistant Conservator

of Foresta, Nagpur, with the powers described in section 71, Act VII. of 1878, (The Indian Forest Act), to be exercised within the limits of the Nagpur district.

No. 3853.—*The 18th October 1880.*—Three months' privilege leave is granted to *Mr. E. Dobbs*, Assistant Conservator of Foresta, with effect from 20th instant, or such subsequent date on which he may avail himself of it.

No. 3858.—*The 20th October 1880.*—*Mr. W. King*, Assistant Conservator of Foresta, assumed charge of the first-class reserves, Betul Division, from *Mr. Whittall*, Deputy Conservator, on the afternoon of the 20th September last, and of the second-class reserves of the same division on the afternoon of the 6th instant.

No. 4083.—*The 29th October 1880.*—Three months' privilege leave is granted to Lieutenant-Colonel *H. C. T. Jarrett, V.O.*, Deputy Conservator of Foresta, with effect from 1st November, or such subsequent date on which he may avail himself of the same.

No. 4280.—*The 11th November 1880.*—Lieutenant-Colonel *H. C. T. Jarrett, V.O.*, Deputy Conservator of Foresta, availed himself of the privilege leave granted him by Notification No. 4083, of the 29th October last, on the forenoon of the 2nd instant.

No. 4281.—*Mr. E. Dobbs*, Assistant Conservator of Foresta, availed himself of the privilege leave granted him by Notification No. 3853 of 18th October last, on the 27th idem.

Mr. E. D. M. Hooper, Assistant Conservator of Foresta, reported his arrival at Seoni, and assumed charge of that Forest Division from *Mr. E. Dobbs*, on the afternoon of the 26th October last.

No. 4413a.—*The 18th November 1880.*—In supercession of Notification No. 1824, dated 14th May 1880, the Chief Commissioner is pleased, under section 75 of Act VII. of 1878 (The Indian Forest Act), to prescribe and limit the duties of certain Forest Officers, and to provide for the payment of rewards to certain officers and informers by the following rules:—

I. The Conservator of Foresta, all Deputy Commissioners, Assistant Commissioners, Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators (whether probationers or otherwise), Tahsildars, Forest Rangers, Foresters and Forest Guards, whether in permanent or temporary employment, are appointed to do all acts and exercise all powers that are provided by the Act to be done or exercised by any Forest Officer.

II. With the exceptions provided by rules III. and IV. the powers mentioned in the third column of the following schedule will be exercised by the officers mentioned in the first column of the same schedule opposite which they appear.

Class of Officers empowered.	Section of the Act under which powers are given.	Brief description of nature of powers conferred.
I.—All Deputy Conservators, Assistant Conservators and Sub-Assistant Conservators when in charge of Forest division.	30	To publish translation of Notifications of reserved forests.
	35	To notify seasons during which the kindling, &c., of fire is not prohibited.
	45	To notify depots for drift timber, &c.
	46	To issue notice to claimants of drift timber, &c.
	47	To decide claims to drift timber, &c.
	50	To receive payments on account of drift timber, &c.
	53	To sell forest produce for Government dues.
II.—All Deputy Commissioners, Assistant Commissioners, Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators and Tahsildars and all Forest Rangers.	60	To direct release of property seized.
III.—All Deputy Conservators, Assistant Conservators, Forest Rangers and Foresters, specially authorised in that behalf by the Conservator of Forests.	26	To permit acts otherwise prohibited in reserved forests.
	52	To take possession of forest produce referred to in section 57 of Act VII. of 1878.

III. The Conservator of Forests is empowered to exercise all or any of the powers conferred in the foregoing schedule.

IV. In respect of second class Reserved Forests, Deputy Commissioners will exercise all or any of the powers conferred on the Conservator of Forests.

V. The Conservator of Forests is empowered, under section 24 of the Act, with the previous sanction of the Commissioner of the Division, to stop ways and watercourses in reserved forests, subject to the provisions of that section.

VI. All Revenue Officers below the rank of Tahsildar, and all Police Officers up to and including Inspectors, and all Forest Officers including clerks and messengers below the rank of Sub-Assistant Conservator, as well as persons not in the public service, are eligible for rewards under the following rules:—

VII. On conviction of an offender, the Magistrate by whom the case has been decided is authorized to grant a reward not exceeding the estimated value of the timber or other forest produce, or other articles confiscated, plus the amount of any fine imposed (and not exceeding Rs. 100) in such proportions as he may think fit, to any person or persons who may have contributed to the seizure of the property confiscated or the conviction of the offender.

VIII. If in any case the Magistrate considers that more than Rs. 100 should be distributed as rewards, he shall submit his recommendation for a larger reward through the Conservator of Forests for the orders of the Local Government, giving his reason for the same.

IX. In cases where, under section 67 of the Indian Forest Act, a Forest Officer has accepted a sum of money as compensation for any damage which may have been committed, the Conservator of Forests may authorize the payment of a portion of the amount

Rewards to informers when the offence has been compounded.

realized as a reward to any person or persons who may have contributed to the discovery of the offender.

No. 4605.—*The 7th November 1880.*—Under section 26 of Act VII of 1878 (The Indian Forest Act), and with the sanction of the Governor-General in Council, the Chief Commissioner is pleased to declare that the undermentioned portion of the 2nd Class Reserved Forests of the Mandla District shall, from this date, cease to be a reserved forest:—

A. R. P.

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No. 4812.—*The 24th December 1880.*—*Mr. W. Ring*, Assistant Conservator of Forests, having reported his arrival at Madras from furlough on the 12th September last, the usual subsidiary leave is granted him to enable him to join his appointment at Betul in these Provinces.

No. 4796.—*The 23rd December 1880.*—In exercise of the powers conferred by section 19, Act VII of 1878, the Chief Commissioner is pleased to declare the forests specified below, to be Reserved Forests from this date:—

Mausa Budhon, in Tahsil Kurai, in the Saugor district: bounded on the north by the village lands of Jamun Kheri and Ghorat, on the east by the village lands of Ghorat and Khiria, on the south by the village lands of Budhon, and on the west by the village lands of Binaita.

Mausa Pithoria, in Tahsil Kurai, in the Saugor district: bounded on the north by the Chandrapura block of No. IV. or Bandri Reserved Forest, on the east by the village lands of Pithoria, on the south by the village lands of Chiraru and Parasri, and on the west by the village lands of Semra Jambudwip and Hanmantpahari.

Mausa Chiraru in Tahsil Kurai, in the Saugor district: bounded on the north by the village lands of Pithoria, on the east by the village lands of Pithoria, Pirei and the Pirei block of No. IV. or Bandri Reserved Forest, on the south by the Pirei block No. IV. Bandri Reserved Forest, and on the west by the village lands of Chiraru.

Mausa Semra Jambudwip and Kanera Gond, in Tahsil Kurai in the Saugor district: bounded on the north by the village lands of Kanera Gond and Hanmantpahari, on the east by the village lands of Semra Jambudwip, on the south by the village lands of Parasri and the Jamunia Dhiraj tract of No. XII. or Basia Gond Reserved Forest, and on the west by the Emanpur and Chouka Pathari tracts of No. XII. or Basia Gond Reserved Forest.

Mausa Baheria, in Tahsil Kurai, in the Saugor district: bounded on the north by the village lands of Baheria and Chouka Pathari and the Jamunia Dhiraj tract No. XII. of Basia Gond Reserved Forest, on the east by the village lands of Parasri and the Maria tract of the above Reserved Forest, on the south by the Basia Gond tract of the above Reserved Forest, and on the west by the village lands of Basia Gond.

Mausa Hanota, in Tahsil Kurai, in the Saugor district, comprising an area of 132 acres: bounded by the Reserved Forests of Khitosa, Dewal, Patgaon and Hanota.

6.—BRITISH BURMAH GAZETTE.—

No. 68.—*The 18th September 1880.*—The forest situated in the Hlaing township, Hanthawaddy district, bounded as below, having been sanctioned by the Chief Com-

missioner as a Government reserved forest, under sections 13 and 14 of the Forest Rules of 1865, is hereby notified as the *Oke-kan State Reserve*, subject only to the rights enumerated in the statement of rights.

Area,—about 125 square miles.

No. 64.—*The 18th September 1880.*—It is hereby noted that the Chief Commissioner has sanctioned as a Government reserved forest, in accordance with sections 13 and 14 of the Forest Rules of 1865, the forest situated in the Shway-gyin district, Tenasserim division. The reserve will be known as the *Kyone-toung State Reserve*. Its area is about $1\frac{1}{2}$ square miles. The privileges to be allowed to the public within the limits of the reserve are shown in the statement hereto appended.

No. 68.—*The 23rd September 1880.*—*Mr. O. W. Palmer*, Assistant Conservator of Forests, 2nd Grade, is promoted to the 1st Grade of Assistant Conservators, with effect from the 1st April 1880.

No. 69.—*Mr. N. Hearle*, Assistant Conservator of Forests, 3rd Grade, is promoted to the 2nd Grade of Assistant Conservators, with effect from the 7th June 1880.

No. 70.—*The 24th September 1880.*—*Mr. John Nisbet* Assistant Conservator of Forests, availed himself, on the forenoon of the 1st instant, of the privilege leave granted to him in this Department Notification No. 55, dated the 6th August 1880.

No. 408.—*The 23rd September 1880.*—*Mr. F. S. Copleston, O.S.*, relinquished charge of his duties in connection with forest demarcation in the Toungoo district on the 24th May 1880.

No. 74.—*The 30th September 1880.*—It is hereby notified that the Chief Commissioner has sanctioned, as a Government reserved forest, in accordance with sections 13 and 14 of the Forest Rules of 1865, the forest situated in the Amherst district, Tenasserim division. The reserve will be known as the *Ka-maw-kala State Reserve*. Its area is about nine square miles :—

Boundaries.

North.—The Day-law stream.

East.—The Thoung-yin river.

South.—A demarcated line from a point on the Thoung-yin river just above the Ka-maw-kala rapids, following the southern foot of the Ka-maw-kala range to the crest of the Meh-paleh east watershed.

West.—The Meh-paleh east watershed range.

No. 76.—*The 30th September 1880.*—It is hereby notified that the Chief Commissioner has sanctioned, as a Government reserved forest, in accordance with sections 13 and 14 of the Forest Rules of 1865, the forest

situated in the Amherst district, Tenasserim division, bounded as below. The reserve will be known as the *Mah-ka-nah State Reserve*. Its area is about 30 square miles. The privileges to be allowed to the public within the limits of the reserve are shown in the statement.

No. 77.—*The 30th September 1880.*—It is hereby notified that the Chief Commissioner has sanctioned, as a Government reserved forest, in accordance with sections 13 and 14 of the Forest Rules of 1865, the forest situated in the Amherst district, Tenasserim division, bounded as below. The reserve will be known as the *Mah-gala State Reserve*. Its area is about 10 square miles. The privileges to be allowed to the public within the limits of the reserve are shown in the statement.

No. 80.—*The 30th September 1880.*—It is hereby notified that the Chief Commissioner has sanctioned, as a Government reserved forest, in accordance with sections 13 and 14 of the Forest Rules of 1865, the forest situated in the Amherst district, Tenasserim division, bounded as below. The reserve will be known as the *Kyauk-ke State Reserve*. Its area is about 19 square miles. The privileges to be allowed to the public within the limits of the reserve are shown in the statement.

No. 79.—*The 14th October 1880.*—It is hereby noted that the Chief Commissioner has sanctioned, as a Government reserved forest, in accordance with sections 13 and 14 of the Forest Rules of 1865, the forest situated in the Toungoo district, Tenasserim division, bounded as below. The reserve will be known as the *Ka-boung State Reserve*. Its area is about 345 square miles. The privileges to be allowed to the public within the limits of the reserve are shown in the statement.

No. 88.—*The 17th November 1880.*—*Mr. John Nisbet*, Assistant Conservator of Forests, reported his return from the privilege leave granted to him in this Department Notification No. 55, dated the 6th August 1880, on the 29th ultimo. The unexpired portion of his leave is accordingly cancelled.

No. 89.—*The 15th December 1880.*—The Chief Commissioner sanctions the promotion of *Mr. J. N. Pickard*, Assistant Conservator of Forests in British Burma, from the 3rd to the 2nd Grade of Assistant Conservators, with effect from the 8th November 1880.

No. 402.—*The 11th November 1880.*—At the examination held in Rangoon on the 8th November 1880, and following days, the undermentioned officers passed the tests in the Burmese language prescribed in this Department Notification No. 202, dated the 19th September 1876:—

By the Higher Standard:

Mr. J. Nisbet, Assistant Conservator of Forests.

By the Lower Standard:

Mr. J. N. Piskard, Assistant Conservator of Forests, with credit.

Mr. H. B. Ward, Assistant Conservator of Forests.

No. 90.—*The 23rd December 1880.*—*Mr. T. A. Hauxwell*, who has been appointed by the Secretary of State for India an Assistant Conservator of Forests in British Burma, reported his arrival in Rangoon on the 22nd instant, before noon.

Mr. Hauxwell is posted to the Tharrawaddy Division, Pegu Forest Circle.

No. 93.—*The 24th December 1880.*—The following notification is issued, by order of the Chief Commissioner, under the provisions of Rule XII. of the Rules for the Administration of Forests in British Burma, dated the 2nd August 1865, in continuation of Revenue Department Notification No. 71, dated the 23rd September 1880, and with reference to the concluding portion of paragraph 1 of Notification No. 33, dated the 8th March 1876:—

Within the Government forests no Thitto trees (*Sandoricum indicum*) of below 16 feet in girth, measured at six feet from the ground, may be felled, cut, tapped, or otherwise used without a permit granted by an officer duly authorized in that behalf, except when they are cut down in clearing ground *bonâ fide* for the purpose of cultivation.

This notification shall have effect from the date thereof, namely, the 24th December 1880.

7.—MYSORE GAZETTE—

No. 114.—*The 16th October 1880.*—*Mr. D. E. Hutchins*, Assistant Conservator of Forests, Nundydroog Division, is granted examination leave from the 14th instant to the 1st November 1880, inclusive, under Chapter I, paragraph 22, of the Forest Department Code.

No. 124.—*The 11th November 1880.*—*Mr. D. E. Hutchins*, Assistant Conservator of Forests, Nundydroog Division, has passed the prescribed examination in Kanarese by the Higher Standard.

No. 180.—*The 16th November 1880.*—*Mr. D. E. Hutchins*, Assistant Conservator of Forests, Nundydroog Division, officiating in the 1st Grade, is confirmed in that grade from the 2nd November 1880, the date of his passing the Higher Standard Examination in Kanarese, under the provisions of para. IV of Circular Resolution of the Government of India, Home, Revenue and Agricultural Department, No. 5 F., dated 23rd February 1880.

8.—ASSAM GAZETTE—

No. 268.—*The 8th October 1880.*—*Mr. T. J. Campbell*, of the Revenue Survey, is appointed, as a temporary measure, to officiate as a Sub-Assistant Conservator of Forests in Assam, and is appointed to the Tezpur Division.

No. 269.—*Mr. D. P. Copeland*, Sub-Assistant Conservator of Forests, is transferred from the Tezpur to the Goalpara Division.

No. 819.—*The 18th November 1880.*—*Mr. G. Mann*, Conservator of Forests, Assam, availed himself of the privilege leave granted in Notification No. 245, dated the 23rd September 1880, and made over charge of his duties to *Mr. W. B. Fisher*, Assistant-Conservator of Forests 1st Grade, on the forenoon of the 18th October 1880.

No. 82.—*The 5th November 1880.*—In exercise of the powers conferred by section 41 of Act VII. of 1878 (the Indian Forest Act, 1878), and in supersession of the rules published in the Revenue Department Notification No. 10, of the 11th May 1880, the Chief Commissioner of Assam is pleased to make, and, with the sanction of the Governor-General in Council, to publish, the following rules, which shall come into force on and from the 1st January next:—

CACHAR RIVER RULES.

I.—All words used in these rules and defined in Act VII. of 1878 (the Indian Forest Act, 1878) shall be deemed to have the meanings respectively attributed to them by the said Act.

II.—Passes may be granted for all timber and other forest produce brought down by the Barák and Kátákhál rivers or any of their tributaries in the district of Cachar, at the following revenue stations:—

Sonaimukh, on the Barák river;
Sealteek, on the Barák river; and
Jafferbund on the Kátákhál river;

or at such other revenue stations as the Chief Commissioner may, from time to time, by notification in the *Assam Gazette*, prescribe.

III.—All amounts due to Government in respect of such timber or forest produce, whether as duty, royalty, or on any other account, shall be paid into the Silchar tahsil treasury, or into the Hailákándi or Kátigorá tahsil treasuries, or at such other places, as the Chief Commissioner may from time to time, by notification in the *Assam Gazette*, prescribe; and the treasury receipts shall be handed to the Forest Officer in charge of the revenue stations, who shall thereupon, if requested to do so by the person in charge of such timber or forest produce, grant a pass for the same, in such form as the Chief Commissioner may from time to time prescribe.

IV.—If such timber or other forest produce is brought from private land in British India, in respect of which the Government has not the right to levy a royalty or other payment, and accordingly nothing is due to Government thereon, the Forest Officer shall grant a pass for the same on production of a certificate in the form appended to these rules, and signed by the owner of the land whence the timber or other forest produce has been derived, or by his agent authorized in that behalf. Such certificate, if a pass has been granted in exchange for it, shall be detained by the officer granting the same: Provided that the Forest Officer may decline to grant such pass if he has reason to believe the certificate to be false. No pass shall be granted except in exchange either for a treasury receipt or for a certificate as hereinbefore provided.

V.—For the issue of such passes, fees will be levied as follows :—

	Rs. As.
(1) For every raft of timber or bamboos or boat carrying timber or bamboos, and for every raft or boat carrying charcoal.....	1 0
(2) For every raft of canes or boat carrying canes.....	0 8
(3) For every raft of thatching-grass and reeds or ekra or boat carrying the same.....	0 4

Provided that no fees shall be levied for passes granted in respect of timber and other forest produce brought from private land in British India.

VI.—No person shall move any timber or other forest produce below any of the said stations, until a pass has been granted by the Forest Officer in charge of such station.

VII.—Should the persons in charge of any timber or other forest produce brought down the Barák and Kátákhál Rivers or any of their tributaries in the district of Cachar, desire to land such timber or other forest produce before reaching any of the said stations, they shall obtain the permission in writing of the Forest Officer in charge of the nearest station. If such officer deems fit to grant such permission, he shall examine and measure the timber and other forest produce, and shall, on being handed the treasury receipt acknowledging payment of the amount due to Government thereon, or in lieu thereof a certificate of origin as prescribed in Rule IV., grant a pass as hereinbefore prescribed.

VIII.—Except with the permission in writing of the Forest Officer, no timber or other forest produce in transit on the Barák and Kátákhál Rivers, or any of their tributaries in the district of Cachar, may be landed or removed inland, nor may such timber be cut up, or converted, before a pass has been granted by the Forest Officer for the same.

IX.—All timber and other forest produce which is brought down any river in the district of Cachar may be stopped and inspected by any Forest Officer or Police Officer; and all persons in charge of such timber or forest produce shall be bound to produce any passes which may have been granted to them under these rules, when called upon to do so by such Forest Officer or Police Officer.

X.—Any person infringing any provision of these rules shall be punished with imprisonment of either description which may extend to six months, or with fine which may extend to five hundred rupees, or with both.

Certificate of Origin required under the provisions of the Cachar River Rules for private timber or other forest produce.

1. Name, caste, and father's name, of the owner of the land whence the forest produce covered by this certificate was derived :—

.....

2. Residence of the owner of the land whence the forest produce covered by this certificate was derived :—

.....

3. Name of village or estate where the timber or other forest produce was cut :—

.....

4. Description of timber or other forest produce :—

.....

5. Amount of timber or other forest produce :—

.....

6. Name, caste, father's name, and residence of person in charge of timber or other forest produce :—

.....

7. Destination to which the cargo is to be conveyed :—

.....

I, A. B., son of C. D., the person named in the first entry above (or *his agent duly empowered to grant this certificate*), do hereby declare that the timber (or other forest produce, as the case may be) specified in this certificate was cut upon my (or, *my principal's*) private land, and that no portion of the said timber (or other forest produce, as the case may be) is the property of Government or produced on Government land.

(Signed) A. B.

No. 845.—*The 30th December 1880.*—*Mr. T. J. Campbell*, Officiating Sub-Assistant Conservator of Forests, received charge of the Tezpur Forest Division on the afternoon of the 30th November 1880, from *Babu Jay Narayan Das*, Forest Ranger.

9.—BOMBAY GAZETTE—

The 22nd October 1880.—*Mr. J. C. Stobie*, Acting Sub-Assistant Conservator of Forests, Poona, 3rd Grade, reported his arrival for duty to the Deputy Conservator of Forests, Poona, on the 7th September 1880, before office hours.

No. 6211.—In exercise of the powers conferred by section 4 of the Indian Forest Act, 1878, Government are pleased to appoint *Mr. A. Shewan*, Extra Second Assistant Collector, Satara, to be Forest Settlement Officer in the undermentioned Taluka of the Satara Collectorate, for the purposes set forth in section 4, clause (c) and sections 28 and 34 of the said Act :—

TALUKAS—Wai, Javli, Patan, Satara, Karad, and Walwa.

2. Under section 16 of the said Act Government are also pleased to appoint the Collector of Satara to hear appeals from orders passed by the aforesaid Forest Settlement Officer under sections 10, 11, 14, or 15 of the said Act.

No. 5960.—*The 11th November 1880.*—*Mr. G. K. Batham*, Assistant Conservator of Forests, 2nd Grade, is promoted to the 1st Grade, with effect from 1st September 1880.

The 11th December 1880.—*Messrs. T. B. Fry and B. C. Wroughton*, Assistant Conservators of Forests, respectively delivered over and received charge of the Násik District Forest Office, on the 7th December 1880, before office hours.

Mr. J. C. Stobie, Acting Sub-Assistant Conservator of Forests, on proceeding to take up an appointment in the Land Transport Corps, handed over charge of the Bhor

State Forest Demarcation Office on the 4th December 1880 to *Major Godfrey*, Assistant Superintendent, Revenue Survey, after office hours.

The 14th December 1880.—*Mr. G. A. Hight*, Assistant Conservator of Forests, and *Mr. Waman Ramchandra Gounde*, Head Clerk to the Conservator of Forests, Northern Division, respectively delivered over and received charge of the Ahmednagar District Forest Office on the 6th December 1880, after office hours.

No. 6675.—*The 16th December 1880.*—In exercise of the powers conferred by section 4 of the Indian Forest Act, 1878, His Excellency the Governor in Council is pleased to appoint *Mr. O. E. Frost*, First Assistant Collector of Nasik, to be Forest Settlement Officer in the Málegaon, Nándgaon, Bágán and Kálvan Tálukas of that District, for the purposes set forth in section 4, clause (c) and section 34 of the said Act.

The 17th December 1880.—*Mr. S. Hornidge*, Acting Assistant Conservator of Forests, and *Mr. T. B. Fry*, Assistant Conservator of Forests, respectively delivered over and received charge of the Forest Office, Gujarát Circle, on the 10th December 1880, before office hours.

The 23rd December 1880.—*Mr. S. Hornidge*, Sub-Assistant Conservator of Forests, received charge of the Demarcation Office, Bhor State, from *Major Godfrey*, Assistant Superintendent, Revenue Survey, on the 18th December 1880, after office hours.

We regret that as we do not receive the *Madras Gazette*, we are unable to give notifications from that Presidency.

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[No. 4.]

Nancy Forest School.

MOST of our readers will have learnt ere this that great changes have lately taken place at the Nancy Forest School. M. Nanquette, who presided over the Institution as Director for more than 20 years, and under whose direction many of our Indian Forest Officers have received their professional education, retired on his pension in October last, having attained the prescribed age of 65 years, and M. Mathieu retired at the same time. M. Mathieu was a few years older than M. Nanquette, but the Government requested him to remain, in order to complete the arrangement of the rich collection of woods and other forest produce, which have increased much of late years, notably by the addition of our collection sent from India to the Paris Exhibition in 1878.

It is no disparagement to the merits of their successors to say that the retirement of these two distinguished officers will be felt as a great loss to the Forest School, and the friendly interest with which M. Nanquette and M. Mathieu directed and assisted the studies of the English students will long be gratefully remembered by many Forest Officers in India.

The President of the French Republic has appointed M. A. Puton as Director of the School. M. Puton received his professional education at Nancy, and, after being employed during a series of years in the active service, was appointed to succeed M. Meaume as Professor of Jurisprudence. In French Forest Literature, M. Puton's name is well known by several manuals and other books, the first of which was his "*Service Administratif des Chefs de Cantonement*," which appeared in 1870. He also published a brief and popular manual, chiefly intended for the use of Subordinate Officers and private proprietors of forests, and entitled, "*Aménagement des Forêts*," a second edition of which appeared in 1874. Quite lately, in 1880, he published with M. Guyot, the Assistant Professor of

Jurisprudence, a small book entitled, "*Contrainte par Corps en matière criminelle et forestière.*"

Of the other changes which have been made at the School, it will suffice to mention that M. Bagneris has succeeded M. Mathieu as Deputy Director; that M. Fliche has become Professor of Natural History; and that M. Guyot has replaced M. Bagneris as Director of Studies.

M. Puton, writing on 26th November, speaks in high terms of the "promotion" of 1880, and says they were all to be young men who mean to work hard and to push their way in the world.

D. B.

Report on the Forests of Mauritius.

By R. THOMPSON, *Deputy Conservator of Forests.*

(Continued from p. 241.)

PART II.—DESCRIPTIVE AND FOREST MANAGEMENT.

BEFORE proceeding with a detailed description, and rules for Preliminary Re- the future management of the various marks. forest properties of Mauritius, it will be as well to take a brief notice of the Ordinances under which the creation and protection of some at least of these properties are carried out.

The laws which govern forest property, both public and Forest laws of private, in this Colony, are contained in Mauritius. Ordinance No. 18 of 1874 (as amended) and Ordinance No. 13 of 1875; the latter consolidating, as it were, all previous enactments of the same nature. These two Ordinances, therefore, constitute the whole forest laws of Mauritius, in so far at least as we are concerned with them.

Ordinance No. 18 of 1874, as amended by Ordinance No. Ordinance No. 18 of 15 of 1875, regulates the sale of Crown 1874. lands, and excepts from such sale, the strip of land round the coast known as the "Pas Géométriques," and the Mountain and River Reserves, when such are the property of Government. It provides, however, for the lease of the "Pas Géométriques," but only on condition that the land is planted with trees within a period of five years, and at the annual rate of *one-fifth* of the land so leased. It also provides heavy penalties for any breach of the conditions of con-

tract of lease, and it empowers a lessee to cut and remove trees of twenty years' growth, but not more than *one-tenth* of the trees during any one year, provided and on condition also that the land so denuded be at once replanted. Heavy penalties are provided in the case of any breach of these conditions. It, however, empowers a lessee to apply for and obtain the sanction, in writing, of the Surveyor-General, to thin and prune his trees.

It prohibits the free grant of Crown land, except when such land is required for religious, charitable or educational purposes, when a grant or concession at nominal rates, is permitted, and for so long only as the land is applied to such purposes.

It likewise provides that sales of Crown lands shall be by public auction; and the leases of such lands shall be granted either by public competition or by private contract. It also prescribes the method of procedure to be observed in all such cases.

It prohibits the grant of *jouissances* limited or unlimited; and lays down the action to be taken with reference to squatters on Crown lands. It requires that the Surveyor-General shall watch over Curatelle lands; and appoints him to be the chief executive Forest Officer in the Colony, with powers to appoint, dismiss or otherwise punish Forest Rangers. All Forest Rangers are required by this law, on being appointed, to be sworn before a Stipendiary Magistrate. The Surveyor-General may likewise appoint Forest Keepers to watch over the forest lands of private owners on their so requiring. Rules are prescribed for the engagement of Forest Rangers before the Stipendiary Magistrate of Port Louis; no Forest Ranger being engaged for any longer term than two years. A notification of all appointments of Forest Rangers, or Forest Keepers, is required to appear in the Government Gazette; and such notice of appointment is considered sufficient evidence, before any Court of Justice, as to the right of such Forest Ranger or Forest Keeper to enforce the provisions of the Ordinance.

It likewise enacts that the Police Force of the Colony shall at all times have the same rights and duties as Forest Rangers; and that every Forest Ranger, Keeper or other person qualified to act as a Forest Ranger, shall be deemed a public functionary.

Ordinance No. 13 of 1875 is, however, more comprehensive than Ordinance No. 13 of 1876. in its scope, and may be considered the law governing all classes of forest property in the Island. Its provisions are judicious, and are so framed as to meet all the varying and peculiar conditions of the people and the properties it purposes to protect and to deal with. It confirms the office of Surveyor-General as the Chief

Executive Forest Officer of the Colony. The following is an outline of this excellent and comprehensive Forest Code :—

Chapter I deals with definitions and interpretations of Crown lands; Pas Géométriques; Mountain Reserve Line; Mountain Reserves, Base Line; Mountain Range, River Reserves; Marshes, &c., &c.;

Chapter II makes provisions for dealing with the destruction of timber caused on Reserves, Plantations and Forests;

Chapter III deals with the survey and demarcation of Mountain Reserves;

Chapter IV empowers the Governor in Executive Council to make Regulations, from time to time, for the purpose of carrying out the provisions of this Ordinance, and to alter or revoke the same;

Chapter V makes provisions for enforcing and carrying out of the law; and

Chapter VI lays down the legal procedure to be observed.

These six chapters contain all the necessary Legislation that it is possible to desire, or likely to be wanted in Mauritius for many years yet to come. It may, however, be necessary to consider whether the articles, referring to River and Mountain Reserves, will not require amendment, the reasons for which will be given later on.

The following sketch shows the establishments employed, Existing Forest Establishments, under existing circumstances, for forest protection and management in Mauritius :—

The Protective Establishment consists of a force, on the permanent staff, of 30 Forest Rangers, headed by an official styled the Guardian of Woods and Forests. This Protective Establishment is directly subordinate to the Surveyor-General, and receiving its orders direct from him. In addition to and exclusive of the above force, and with the control of which he has nothing to do whatsoever, is appointed a Director of Woods and Forests. The duties of this officer appear to be that he is required to carry out the work of raising plantations, restocking the natural forests with the more valuable kinds of trees, has charge of existing plantations and the working of the Crown forests.

The establishments employed to aid him in carrying out these duties being of a temporary nature, are charged to such works. As the Director of Woods and Forests is technically a trained officer, for he is also the Director of the Royal Botanical Gardens of Mauritius, it does appear anomalous that one of the principal duties of a Conservator of Forests should not vest with him, but with the Surveyor-General. However, since the law has appointed the latter Chief Guardian of Woods and Forests, the arrangement must stand.

Constitution of the Forest Force. The following is the constitution of the Forest Force and its yearly cost to the Colony:

			Yearly Salary.	
1	Guardian of Woods and Forests	...	Rs. 1,500	
2	I Class Forest Rangers at Rs. 1,080	...	" 2,160	
2	II Class Forest Rangers	" 900	...	" 1,800
5	III Class do.	" 700	...	" 3,500
2	IV Class do.	" 480	...	" 960
19	IV Class do.	" 360	...	" 6,840

Total annual cost ... Rs. 16,760

To the above should be added the annual salary allowed to the Director of Woods and Forests... Rs. 1,200

Making a total charge of ... Rs. 17,960

In addition to the above establishments there are what are called Keepers of Crown and Curatelle lands. It is believed that at present there are three, if not four, such officials, appointed and paid by the Surveyor-General.

The distribution of the Forest Force is as follows, and is given here only in the abstract:—

Distribution and duties of Forest Rangers.

District of Port Louis—area 10 square miles ... 1 II Class Ranger.
3 IV do.

Total ... 4

District of Moka—area 68 square miles ... 1 I Class Ranger.
2 IV do.

Total ... 3

District of Plaines Wilhems—area 70 square miles ... 1 I Class Ranger.
1 III do.
5 IV do.
1 Curatelle Keeper.

Total ... 8

District of Grand Port—area 112 square miles ... 1 II Class Ranger.
5 IV do.

Total ... 6

District of Savanne—area 92 square miles ... 1 III Class Ranger.
1 IV do.

Total ... 2

District of Flacq—area 113 square miles	...	1 III Class Ranger.
		3 IV do.
		1 Keeper of Crown lands.
Total	...	5
Districts of Pamplemousses and Rivière du Rem- part—area 145 square miles	...	1 III Class Ranger.
		2 IV do.
Total	...	3
District of Black River—area 95 square miles	...	1 III Class Ranger.
		1 IV do.
		1 Curatelle Keeper.
Total	...	3

The duties of this Force consist merely in guarding Crown lands, and protecting Mountain and River Reserves; arresting and prosecuting offenders; and enforcing generally the provisions of Ordinances No. 18 of 1874 and No. 13 of 1875. In fact, their duties are strictly those of Police.

The Forest Laws of Mauritius, however, legalise the same and similar duties being performed by the regular Police Force of the Colony. Under those circumstances, therefore, it would appear that the present Forest Ranger Staff is not only ample, but almost superfluous.

There is, however, some misunderstanding on the subject, the result of which is that the forest protective duties have been withdrawn from the Police, and which would appear to be contrary to the direct provisions of the law. Nevertheless it is obvious that a considerable part of the duties, now performed by the Forest Staff, could easily be performed, and with great advantage, by the existing Police Force; such as the protection of River and Mountain Reserves and the "Pas Géométriques," which the law directs shall be protected, and permanently maintained in wood, and which would practically amount to nothing more than the protection of public property, for which the Police Force is the constituted guardian.

Were the misunderstanding, which has been alluded to, removed, it would have the effect of releasing the Forest Rangers from some considerable part of their present duties; and which would enable them then to attend to the more legitimate work lying within the Crown forests and plantations of the Colony. In fact, so little have these men to do with such duties that the Forest Officer from India, who was sent for to inspect and report on the forests of the Island, in frequently asking their aid to be shown over the forests, was repeatedly met by the plea of inability to do so, owing to the Forest Rangers being engaged in prosecuting offenders against forest laws, lying outside of their legitimate jurisdictions. And not

only was this so, as regards the Protective Forest Establishments, but particularly so as regarded the officer who is styled the Guardian of Woods and Forests, and who is the head of the Forest Protective Staff, that in no one instance was that officer able to accompany the Forest Officer from India in his tours of inspection of the forests of the Colony.

In Mauritius we find three distinct classes of forest property, which may be defined as follows :—

I.—The “*Pas Géométriques*” and River and Mountain Reserves.

II.—Ordinary forests, the property of the Crown.

III.—Forests, the property of private owners.

In the case of this class the law of Mauritius is the originator and protector of these properties for the public good ; and they are the only forest properties which the law requires shall be maintained permanently under the growth of trees, quite irrespective of whether the land belongs to private individuals or to the Government.

Class I.
Pas Géométriques,
Rivers and Mountain
Reserves.
 The *Pas Géométriques* is a strip of land, 250 French feet in width, laying along the extreme edge of the Coast all round the Island. River Reserves are strips of land, more or less covered with trees, bordering on each side rivers, streams and rivulets, for the preservation of the water-supply in them. The strip may be 50, 25 or 10 feet in width respectively, on each side measured from the water's edge ; and Mountain Reserves are constituted for the preservation of forest and tree growth, along the crests and sides of mountains, their spurs and isolated hills.

The history of the law, requiring the maintenance, and giving protection to these several properties, dates from the French occupation of the Island. It would appear that, under the former *regime*, this law was interpreted more strictly ; but as time went on, and population began to press onwards from all sides, its provisions were relaxed, insomuch that, at the present day, what were formerly considered as Mountain Reserves are now no longer such but in name. Under the provisions of Ordinance No. 18 of 1875 considerable alterations were made during the codification of all previous Laws, Arrêtés, Proclamations, Notices and Ordinances on the subject. These alterations would appear not to have been judicious, at least in that respect only, as regarded what should constitute Mountain Reserves and rules for their preservation ; inasmuch as existing Mountain Reserves,—since the passing of this Ordinance, and which originally meant the protection of the woods and forests, covering the mountains—are represented at the present day by, in most cases, a mere ribbon of thinned-out forest growth along their crests ; their sides and bases having been cleared away and

brought under cultivation. In some cases, the imaginary lines constituting the Reserve Lines of the Code, pass over and above the mountains and their spurs—hence no Reserves are possible under such circumstances. A study of the new law, and its interpretation of what constitute Mountain Reserve Lines on the ground, will however make this subject clear to any one desirous of making the experiment. This subject has already been brought to the notice of His Excellency the Governor by personal communication.

As regards River Reserves, they have been better managed, especially in the more populous districts. The law requiring that a belt of trees, bordering the rivers and streams, be maintained by the owner of the land, be that owner the Crown or a private individual.

This, like what the Mountain Reserves were intended to be, but are not, is a wise provision of the Legislature. It only requires, at the present day, to be more strictly enforced in all parts of the Colony; and were it thus strictly carried out, and the width of the belt, of protecting trees, always maintained at 50, 25 and 10 feet respectively as the law directs, not measured from the waters' edge, but from the top of the escarpment inland, a very considerable increase to the present water-supply would result; besides, these belts of trees would act as screens, to protect the sugarcane plantations against the violent action of the prevailing winds.

An examination of the Map of the Island will show that were the law relating to Mountain and River Reserves modified in accordance with the views herein expressed, a considerable space of the land would be covered and perpetually maintained with forest and tree growth, to the manifest and ultimate benefit of the health, water-supply and conveniences of the people of the Colony.

<p>Ordinary Class II. Forests, the property of the Crown.</p>	<p>These consist of forests of spontaneous growth, and plantations of woods artificially created.</p>
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A considerable portion of the Crown lands is occupied by Mountain and River Reserves, and forests covering extremely shallow and rocky soils, in which position they are not available for yielding any appreciable outturn in timber or other marketable commodities.

The situation of these lands may be indicated as follows: In the south of the Island, but on the table land, lies a group known as the Grand Bassin Block; another group lies in the centre of the Island, and is called the Piton du Milieu Block; a third group occupying the mountains, spurs and gorges of the Black River District; a fourth group occupying the greater portions of the higher and elevated parts of the Port Louis Range; and the fifth stretching along the mountains, with

some outlying tracts, known as the Grand Port and Flacq Range. Included within these principal groups are, of course, the several outlying small plots of land likewise owned by the Crown, several of which have been brought under plantations of young wood by artificial means. Again a few of these isolated tracts have been leased out to cultivators, and one large block, known as Reduit Domain, on which stands Government House.

With the exception of the Blocks, known as Grand Bassin and Piton du Milieu, there are no other forests worthy of the name. Both these Blocks measure in the aggregate about 8,420 arpents; but after deducting 2,410 arpents of extremely shallow and rocky soil, the total of what may be considered as good forest soil, under spontaneous growth, does not amount to more than 6,010 arpents, although the total area of determined and undetermined Crown lands amounts to 34,342 arpents (or 35,750 acres). As said before, these Crown lands in a great measure constitute what are called Mountain and River Reserves, besides great tracts which lie in the lower parts of the Black River District and which have been entirely denuded of all forest growth.

Viewed as a whole, the Crown forests of the Colony of indigenous growth, whether classed as ordinary forests or Mountain and River Reserves, present a picture, with some slight exceptions, of doleful ruin. From most or all of them the valuable kinds of timber-yielding trees have been cut down and removed. What now remain are the dead, the dying and diseased trees, of mature and immature growth, of the less valuable species, the timber of which was not worth the trouble of felling or the cost of carrying away. These trees, left by former wood-cutters, have since been damaged by hurricanes, which they were unable to resist, owing to the original forest growth having been thinned out in the course of extraction of the more valuable woods; the sudden exposure thus caused to sun light, and to the swaying of the trees by the constant strong winds that blow during the greater part of the year, combined with the attacks of xylophagous insects, have completed the ruin of what at one time were no doubt the noble primeval forests of Mauritius.

With a few exceptional but small tracts lying in the mountains and therefore inaccessible to the wood-cutters, there remains not now a single forest of indigenous growth, containing marketable timber of fair value, in the possession of the Crown. Recently were purchased some forests, which now form a part of the Grand Bassin Block, and which still contain (about 800 arpents) of the untouched growth of centuries, but which are mainly composed of species yielding timber of little value. In these forests, trees of *Canarium Colophania* (the Colophane) and of *Sideroxylon grandiflorum* (the Tambala-

coque) attain a height of 50 feet with a girth of from 12, 14, 16 and 19 feet respectively. Trees of this size are rare, standing on an average about one tree to the acre, but the general forest growth is nevertheless dense and impenetrable, except by paths cut through it; and its average height rarely exceeds 30 feet. These, as well as all existing smaller tracts of forests composed of indigenous species, are evergreen, and are thoroughly tropical as regards their composition and character.

These consist of two classes, namely, forest plantations and plantations created for sanitary purposes.

Plantations. Of the former, there are but four, *viz.*, Powder Mills, Trou aux Cerfs, Terrain Quessy, and Concession Dayot. Of the latter, there are several situated near and around Port Louis; Marsh land at Mon Plaisir; Foreshores of Grand Bay; Foreshores of Poudre-d'Or; Mahebourg; Quarantine Stations and Road Sides—all more or less planted with *Filaos* (*Casuarina equisetifolia*) as nurseries, with the more valuable foreign and indigenous trees intermixed. There are, however, two exceptions to this melange, *viz.*, Concession Dayot and Terrain Quessy, which are natural forests restocked with the more valuable indigenous forest trees intermixed with a few foreign broad-leaved species. It is not practicable to state what the combined areas of all the above plantations amount to, as the data for this calculation are not available, except in a few instances, which will be given shortly.

These, like the Crown forests, are in a state of utter dilapidation. The only forests worth anything at the present day are those belonging to the Honorable Mr. Pitot, situated in the south of the Savanne District, and measuring some 2,000 arpents; and a considerable forest, though not uncut, lying near the Quartier Militaire in the Moka District. The extent of this forest is 4,171 arpents; with these two exceptions the private forests of Mauritius may be said to have been worked out of all valuable timber. It is estimated that, including the above 6,171 arpents, there are not, at the present day, 16,000 arpents of private forests which contain trees of large size, and that at the most 10,000 arpents contain nothing but the dead, the dying and diseased trees of mature and immature growths of inferior species; and that even these are fast, *daily*, disappearing beneath the axe of the wood-cutter and sugar-planter combined.

There are, however, extensive stretches of small growth coming up all over the Island, wherever sugar plantations have been abandoned, or where the heavy timber has been cleared off. Probably there are 50,000 arpents, and more, of such lands available at the present day; all, more or less, covered

with a luxuriant young growth of subspontaneous species—many of these species, of course, are worthless, except as fire-wood—and with a few straggling representatives of the native trees among them in the higher parts of the Island, and which will ultimately grow up into fine timber trees if spared long enough. This secondary but spontaneous growth—a remarkable and hopeful feature in the present state of matters—which is coming up all over the Island, with a few exceptions to be noticed hereafter, if protected from injury and allowed to grow, in 20 years would reforest the Island without a cent being spent on planting.

Of course such growth would not form valuable forests in the sense of timber yield; but for shading the ground, preserving the water-supply, and providing fuel and small building material for the people, it would serve admirably. It would, with the existing Crown lands, Mountain and River Reserves, and the existing private forests, if these could be now saved from further destruction, aggregate upwards of 100,000 acres or thereabouts under wood. or nearly 25 per cent. of the total area of Mauritius, of which only a little more than one-fourth is at present under sugarcane cultivation.

The Crown alone has not created artificial plantations of young woods. A number of small private plantations of *Canarina equisetifolia* or the “Filao” are dotted about in various parts of the Island, forming most picturesque groups of trees in the general landscape of the country. At *Mon Désert*, in the Grand Port District, there is a plantation of over one thousand one hundred acres, and which is supposed to contain two millions of trees valued at one dollar (or 2 rupees) each! All these plantations are in flourishing condition, and are remarkably fine, showing clearly how easy it is for landed proprietors, especially those who can afford the initial outlay, to place under wood such portions of their estates as are not otherwise utilized in the cultivation of the sugarcane. As regards the tree “Filao,” there should be no prejudice against its extensive cultivation in the lower parts of the Island, where the rainfall is moderate, but where the moisture-laden sea breezes cause it to flourish and attain large dimensions, and where few of the better quality of timber yielding indigenous trees thrive. The “Filao” should, as a rule, be planted somewhat thickly, and allowed to attain a height of 25 feet before being thinned, and then only the overtopped trees should be taken out; so that the upper, or crown foliage of the remaining trees, continue to retain and form a thick covering overhead. The introduction of some of the smaller shade-loving shrubs, so plentiful in Mauritius, to cover the ground under the trees, would be an advantage, and therefore ought never to be neglected when laying out new plantations.

Private forest plantations.

Having reviewed in a general way the Forest laws, Forest establishments, the classes into which Forest properties are divided, and given a general sketch of the latter as they exist at the present day, we will now proceed with more detailed descriptions of the Crown forests and Crown lands of the Colony, and offer suggestions for their future management.

We will open with the remark that the areas here given of the Crown properties have been derived from information supplied to us by the Surveyor-General of Mauritius, and are based by him in some cases on actual measurements, and in others on estimates only where the land has not yet been surveyed. We are therefore in no way responsible for the correctness or otherwise of the figures now produced.

The total area of the Crown lands is said to be as follows :—

Determined, i.e., measured	21,123 arpents
Undetermined, i.e., not measured, but estimated	13,219 „

Total...34,342 arpents,

which is equivalent to about 35,750 English acres—the French *arpent* containing 208 square yards more than an English acre, which is of 4,840 square yards.

It would certainly have been more satisfactory to have known the exact quantity of land which the Crown possessed in the Colony, but such information is not available in the Department of the Surveyor-General.

The Map, which has also been supplied by the Surveyor-General on the requisition of the Colonial Secretary, shows the distribution of the Crown lands. From it will be observed that a considerable part of these lands (7,500 arpents) is occupied by what is known as the “Pas Géométriques.” Another large portion (9,452 arpents), a considerable part of which is still undetermined, lies in the mountains and gorges of the Black River District. These lands at one time contained valuable forests, all of which however have been long since cut down and removed, and are now spontaneously replaced by forests of secondary growth, composed of introduced non-indigenous species. Another belt (4,859 arpents), the greater part of which is also still undetermined, stretches along the mountains known as the Grand Port and Flacq Range; while in the north-west, covering to some extent the spurs and ridges of the Port Louis Mountains, are belts of forest carrying lands (3,931 arpents).

In the south of the Island, and having an elevation of 1,400 to 2,300 feet above sea level, lie the group of Government forests (5,801 arpents), the greater part of which were purchased recently, known as the Grand Bassin Block

And in the centre of the Island, constituting a single block (2,798 arpents) lie the forests of Piton du Milieu.

We may therefore divide, including outlying neighbouring plots, the Crown forests and Crown lands into six principal divisions or groups, as follows :—

I.—“ Pas Géométriques,” estimated area ...	7,500 arpents.
II.—Gorges and mountains of Black River District	9,452 ”
III.—Grand Bassin Block... ..	5,801.5 ”
IV.—Mountain Range of Grand Port and Flacq ...	4,859.5 ”
V.—Piton du Milieu... ..	2,798.5 ”
VI.—Mountain Range of Port Louis	3,931. ”
Total ...	<u>34,342.5 arpents.</u>

The Map, in which the Crown lands which have been determined are tinted yellow, and those still undetermined brown, show how very scattered these lands are. It is quite obvious that with outlying plots the difficulties of protection are considerably increased, besides rendering it more costly.

The “*Pas Géométriques*” is a strip of land, which is maintained by law, marching with the coast all round the Island. In some places the continuity of this strip is broken, owing to private rights intervening. In others again the strip is considerably widened, due to lands lying alongside being the property of Government. In the greater portion the exact limits of the “*Pas Géométriques*” has been determined, but there still remain considerable portions of it, and the adjoining lands, which have not yet been defined or settled; and which, in some instances, are still in the hands of private persons.

It has already been stated the law compels that the “*Pas Géométriques*” shall be planted with trees, either at the expense of the Crown by the Surveyor-General, or by lessees who may lease the land; the latter on condition that one-fifth of it be planted up yearly, and one-tenth of the trees be realized annually, after the growth of twenty years; and, also, provided that lessees immediately replant the land from which the trees were removed. Failing in any one of these conditions are heavy penalties attached.

At the present time, however, the whole of the “*Pas Géométriques*” is not under trees, though a very considerable portion of the land has been planted up, both by the Crown and by private persons. The tree selected for this purpose is the “*Filao*” (*Casuarina equisetifolia*.) Many of these plantations

are in a very flourishing condition, the trees growing remarkably well and vigorously. In time they will form, when the whole of the land has been planted up, a magnificent living, flourishing evergreen belt of tree vegetation all round the Coast; and which no doubt, shortly hereafter, when thinnings are made, will furnish a considerable supply of building material and fuel.

This will consist, at least for the present, in planting up all the available ground as vigorously as funds at the disposal of the Government will admit. The work should be begun and carried through in a systematic manner, and not spasmodically, as appears to have been somewhat the case. There is nothing easier than to lay out, at the beginning, a systematic plan of work, and then to carry it out fully. The plantations should be laid out in lines six feet apart, and the young trees planted at distances three feet apart in the lines. This will give 2,420 trees to the acre, not too much for a species like the Filao, which will attain the height of 25 feet when so spaced out without requiring to be thinned. However it is not intended that all the future plantations should consist of only one species. On the contrary, the Filao must be looked upon in a great measure merely acting as nurses to the more valuable kinds. The following are recommended for seaside planting, and for stocking permanently the Pas Géométriques and contiguous lands. It is of importance that a selection should be made of such trees as will give a return in yield of fruits, the right to collect and sell which may be leased out annually:—(1) *Mango*, (2) *Jack*, (3) *Tamarind*, (4) *Bread-fruit*, (5) *Litchi*, and other fruit-bearing shade and shelter-yielding trees. The plantations of such trees should be laid out at sufficient distances apart, tree from tree, as will not necessitate the removal of any, when the Filaos, which have acted as nurses, will have all been cut out. The cost of planting and any necessary guarding during the earlier stages of the plantation will be fully repaid by the value of the Filao poles and firewood produced.

These should never be undertaken hastily. It is one of the faults of existing management that thinning, with the view of improvement and making money, is attempted too soon and carried out too vigorously for the health and future stability of the remaining trees. As a rule, no thinning ought to be attempted so long as the young trees, overtopped, do not show signs of utter suppression, when the *latter only* ought to be taken out, and *no others*. What should be chiefly looked to, is the maintenance of constant shade over the soil of the plantation by the remaining growing trees, whose crowns of foliage should touch one another, without being awayed by the winds. Nothing but

compact masses of growth can resist the hurricanes; and no forests can be said to be in healthy, vigorous growth, unless the canopy of foliage above is sufficiently compact to obstruct the direct rays of sun-light from reaching the soil below.

Moreover, lopping or pruning should not be attempted in plantations of forest trees; it is not required, and it is not possible, unless the trees originally stand so far apart that they can develop large side branches; or which can only be, when thinning out heavily, at an early stage of growth, is practised.

The remarks, contained in the foregoing paragraph apply with considerable force to the present management of these plantations. These plantations, of mixed Indian and other foreign species, were commenced in 1870, and are now therefore of 10 years' growth. They comprise an area of 180 arpents situated in the Pamplemousses District. The growth of the trees has been remarkably rapid, and in good form and shape, but the plantation has been much injured by severe thinnings and loppings of the larger branches.

Amongst the Indian trees are *Teak*, *Pterocarpus Marsupium*, *Terminalia Arjuna*, *Albizia procera*, which have attained a height of thirty feet, also *Dalbergia latifolia* and *Sissoo*, both of which promise well for the future; *Cassia florida*, *Berrya Ammonilla*, *Bassia longifolia*, *Pterocarpus santalinus* and *indicus*, all of which are growing fairly well.

It is believed that already a considerable revenue has been derived from the sale of thinnings and prunings against the cost of the plantation, which, up to end of last year, amounted to Rs. 8,886, or nearly Rs. 50 per acre. Nothing could be finer or more flourishing than this plantation, but which unfortunately, at the outset, has met with some severe treatment, but which it will, no doubt, get over if future hurricanes do not knock it about too severely.

At present the very best treatment this plantation could receive would be, to let it alone for a few years, and not to attempt to remove any trees except those—and a very few there can possibly be—which have been overtopped, and whose chance of making a start again is now entirely lost. Where blanks exist, these should be planted up with fast-growing species, of two and three years old stock, that can bear transplanting well; so that they might catch up the existing growths and thus form a compact forest. No cleaning is required, nor is it at all necessary when the young trees have outgrown weeds, &c., but creepers, which twine round the stems of the young trees, should be killed.

The foregoing remarks are not offered in any disparagement of the good work done by the two Directors of the Royal Botanical Gardens (Messrs. Horne and Cantley); on the con-

trary, what these officers have done for the Colony in the way of getting up successful plantations of trees will be a lasting credit to their management. The remarks are merely meant to indicate what ought to be avoided in future; as much depends on the present treatment the plantations receive, whether they will become healthy remunerative forests in the future. Present revenue must not be looked for; and on no account should it be insisted upon.

There are, besides the Powder Mills, several other plantations in the lower parts of the Island, near and about Port Louis and elsewhere; but as they are all in excellent condition, and bear every promise for the future, we shall leave them with these brief remarks. Thoroughly trained horticulturists as the Directors are, they do not require any teaching in their own special branch.

They must however not thin their plantations, except by the removal of already overtopped trees. Lopping will not be necessary then; and every endeavour should be made to maintain a dense undergrowth, *beneath* the young trees, as dense as they can possibly create it, and which is quite possible with the numberless shade-loving species which abound in Mauritius. It will be then, only with perfect cover overhead, and immediately in contact with the soil, that the forest growth will not only be vigorous, but the soil, which is physically of a porous nature, will be kept perpetually moist when shaded from the sun, and screened from the drying action of the winds. In most of the Filao plantations in the Colony, there is absolutely no cover beneath the young trees, and it has been said that nothing will grow there. This, it is certain, is generally not the case; for wherever undergrowth has been allowed to come up, it has flourished and screened the soil from the drying effects of the winds, and increased the vigour of the Filao thereby.

The estimated area of the gorges and mountains of Black River is 9,452 arpents. The forests are situated at various elevations between 400 to 2,000 feet above sea level, on the steep slopes and valleys of the gorges of the Black River, with a fringe of wood running along the brow on the edge of the plateau above. The valuable trees have all, long since, been worked out. A few trees of first class size, *i.e.*, of over 6 feet in girth, are met with, situated on ledges overhanging rocky precipices, and which in such situations are not available to the wood-cutter. The belt of worked out forest on the brow of the plateau still consists of a few fine Nattes (*Imbricaria masima*), the most valued of all timber yielding trees; but the majority of the trees composing this belt consist of the less valuable species in a greater or lesser

2.—Gorges and Mountains of Black River District. Situation, extent and present condition.

stage of decay. A young and vigorous growth, however, is rapidly filling up the forest, composed chiefly of such species as the Natta, the Makak (*Imbricaria petiolaris*), several of the more useful Pomes (*Eugenia*) and Ebony. It is remarkable the way in which this young growth has shot up, after the former forests were cleared away, and what is still more remarkable is, that the young forest is not coppice regrowth, but sprung direct from the seed.

Wherever this young growth exists, it is perfect as regards proportions in which the more valuable species are mixed, and their distribution over the ground. No artificial plantation could ever compete with this natural regrowth, which has appeared, after the mature forests had been removed. The cutting of the old forests in these localities was evidently that of clear cutting, for apparently everything was removed off the ground either in the shape of timber or of fuel. As instances of which and the young growth alluded to, the tracts of forest land known as Terrain Quessy, both private and Crown property, may be indicated.

However, it is only on the brow of the table land that this has occurred. The great mass of the forest on the steep slopes of the mountains, and filling the valleys, are, however, composed of mostly inferior introduced species, which have taken up and occupied the ground after the indigenous trees had been removed. These subsontaneous species now form perfect, compact, well grown forests in most parts of the gorges, comprised of such species as *Tetranthera laurifolia* and *monopetala*, *Albizzia Lebbek*, *Tamarinds*, *Guavas*, &c., intermixed here and there, but much more so at the higher elevations, with some of the indigenous species of the Island.

One-half of the area of this group of forest land is, however, very nearly bare of all forest growth. The range known as the Tamarind Mountain, and the land lying along the left bank of the Black River just opposite, are instances.

From their situation the majority of these forests are of not

Future management.

much immediate value; but since a great part of the soil is still capable of being, under good management, brought to bear healthy forests, it may as well be to show how this is possible under existing circumstances.

Beginning on the table land, it will be necessary to remove

all dead, dying and decaying trees, and
Forests on table land : sparing all those that are still healthy and
their treatment. capable of producing and shedding seed.

Owing to the heavy rainfall in this locality, about 160 inches per annum, it would perhaps be best to make a clear cutting of all such trees that have attained maturity; and where reproduction has naturally not been complete or full, assist it by planting from nursery stock not younger than three year old.

Younger plants will not do, as they will get grown over, and will constantly be cut back by the deer. It will be necessary to establish seed beds and nurseries on the spot to save carriage and risk to the young plants of removal over long distances. With this view extensive collections of seeds of the "Natte," "Makak," "Bois de fer," "Bois Sandal," "Tatamaka" and of other valuable indigenous species should be made, and sown as quickly as possible. No young seedlings should be dug up in the natural forests and brought to nurseries, but seedlings should be raised in seed sown beds. Watering will not be necessary, but the seedlings should be transplanted once or twice in the nurseries to cause them to develop more fibrous roots. In restocking natural forest growth, it will be sufficient to put the plants in where they are required by the existing blanks, or where a more perfect intermixture of good timber-yielding species is desired. They may, likewise, be put out in lines, cleared six feet wide, in a single row at four feet apart between plants. This only when the spaces, taken up by the cleared lines, are already occupied by species it is not desirable to retain. Otherwise it would be well, where the intermixture of good species is tolerably fair, as at Terrain Quessy, only to fill up blanks, and leave the remainder as it stands. No thinning or pruning should be attempted. It will be sufficient if the Forester in charge see that no valuable species are being overtopped and thereby suppressed by their inferior neighbours; and it will be his duty to cut back any inferior species thus gaining ground over the more valuable kinds. But it must always, however, be remembered that we are dealing here with evergreen tropical forests, of which there are rarely few species composing them, that cannot stand shade, and which are not permanently injured by isolation and exposure.

Camphor trees (*Cinnamomum Camphora*) have been tried at Terrain Quessy, and with some success.

Camphor and other foreign trees.

Perhaps a few may still be introduced in the artificial melange, but it is not recommended as it is not a valuable timber-yielding tree; and many of the indigenous trees are of still greater value in their ultimate yield and the shade which they throw on the ground. These properties ought not to be overlooked—it being, also, remembered that the indigenous trees stand out the hurricanes best, for which they are specially suited. They have been tried and found to resist them, whereas many of the foreign species, although rapid growers, have yet to be tested in this respect; when raised in masses, probably thus, they will withstand the hurricanes, but the experiment is still untried. Great caution is therefore necessary in recommending, where large and expensive plantations are concerned, what species to select from among the numerous foreign kinds that will undoubtedly grow.

with much vigour and rapidity in the soil and climate of Mauritius; but as to what their ultimate fate will be, with disease, hurricanes and a generally shallow soil, is harder still to predict. However, a list of the most likely species, and which may be tried tentatively, is appended to this Report.

The treatment of the forests, occupying the steep slopes of the mountains, is to leave them as at present guarded and protected from destruction. The slopes are much too steep for any regular cultivation. In time the more valuable indigenous species will creep in and probably suppress the present almost valueless growths. Their power to stand shade, during the earlier stages of growth, give the indigenous species a considerable advantage over their foreign rivals, who will no doubt begin to disappear as soon as they find themselves overtopped. However, as these forests stand at the present day, they do much good by clothing the steep sides and slopes of the mountains, and by shading the ravines which drain off the waters from them.

As regards the valleys, where the soil is tolerably deep and somewhat rich, plantations of Eucalypts, Auricarias, Mahogany and the Toon (*Cedrela Toona*) may be tried with advantage. These valleys are sheltered, and probably therefore the plantations would in such situations escape the more destructive effects of the hurricanes. In some of the higher valleys, the Eucalypts and Araucarias will find a congenial home, while the lower parts will suit the Toon and Mahogany best. The Toon might most decidedly be largely introduced into the Colony, and planted in along the bottoms of the deep ravines which score the surface of the Island. In such localities the tree would escape the full force of the hurricanes. It grows remarkably well, as far as tried, in the soil and climate of Mauritius; and its timber will be extremely valuable for furniture and constructive purposes. It besides yields a dense shade.

The treatment which the open bare lands of Mountain Tamarind, the bare strip along the left bank of the Black River and *Morne Brabant* will require, will be somewhat as follows:—

I.—It will be necessary to plant up, with one-year old seedlings of *Terminalia tomentosa* and *Arjuna*, the wet black soil, the plants being placed out in lines five feet apart, and three feet apart within the lines. The seed to be obtained from India. Mixed with the *Terminalias* should be *Eugenia Jambolana*, in the proportion of one in ten of the other. The spaces between lines should be sown in plots, 12 × 12 inches, with the seeds of various evergreen shrubs common to the Island. The seeds of *Tetranthera laurifolia* should also be plentifully gathered, and sown in plots, in all the drier parts outside of the black

wet soil. The plots should be prepared by digging down nine inches deep and removing the larger stones from the soil; they should be arranged in lines parallel with the planted lines. All original growth, at present on the ground, should be strictly preserved, even where it falls within the lines of plots or plants. Sowing and planting should be commenced early in the beginning of the north-west monsoons, and should never, on any account, be carried farther into them than one month after they have commenced: this will then give the transplants and germinating seedlings the benefit of all subsequent showers, which will help considerably to establish them before the setting in of the dry weather. All preliminary operations, such as digging the pits for the plants and preparing the plots for seed sowing, should therefore be carried out before the monsoon rains begin, which will probably be by or about 1st December.

II.—The steep slopes of the Tamarind Mountain should be sown with a mixture of seed, such as that
 Method of treating Mountain Tamarind. of *Tetranthera laurifolia*, *Albizia Lebbek* and *procera*, *Dalbergia latifolia*, *Bassia longifolia*, *Pterocarpus Marsupium*, *Acacia leucocephala* (if that is not already established there), *Adenanthera pavonina*, and such of the indigenous evergreens growing usually at such altitudes. The seeds should be sown in horizontal contouring beds, the continuity of which must be broken wherever natural growths, now occupying the sides of the mountain, are met with. These beds need not be more than two feet wide, the soil well worked up in them, and the stones extracted and laid along the *outer* edge; the beds must slope inwards slightly to keep the soil from being washed away by the rain, and the seed sown over the whole surface of the beds. Before sowing, the seeds should be thoroughly mixed up together, the heavier and larger, and the smaller and lighter, seeds all together. A *very slight* covering of soil is all that will be necessary to put over the seeds. The distance between consecutive beds will be regulated by the slope of the mountain, and may be, according to it, 10, 15, or 20 feet. Inspection paths must be laid out at the time the beds are being prepared; these paths need not be more than three feet wide, with a slope of 1 in 30 or 35. In fact such paths—a fine example of which may be seen leading to the bottom of the *Trou aux Cerfs*, built by Mr. Lavignac, who lives down there. In fact all mountain forests ought to be provided with similar inspection paths, which can be constructed at little expense, and which could always be kept in thorough repair by the Forest Rangers.

III.—As regards *Morne Brabant*, it will probably be best to plant it with *Filaos*, unless there is considerable rock underneath the surface soil, when perhaps the best way of getting it under tree vegetation will be by sowings
 Method of treatment for Morne Brabant.

carried out in a manner similar to that suggested in the case of Tamarind Mountain.

Under a combined system of sowing seeds in horizontal bands and plots, and planting out in pits young trees previously raised in nurseries, any of the now bare bleak hills in the Island

may be successfully reclothed with tree vegetation. As a fact a considerable young growth, but scattered about in patches, even now covers the bleakest hill sides. What is chiefly required for it is protection, and the blanks filled up artificially, the probable cost of which will not exceed Rs. 20 per acre, where sowing alone is carried out; but under a composite system, namely, that of sowing and planting, the cost will be raised to about Rs. 30 per acre. This would include the collection of the seed, raising young plants in nurseries, preparing the soil, planting and sowing the seed—the price of labour being the only heavy item all through. It must, however, be distinctly understood that artificial watering of the plantations is neither anticipated nor allowed a place in the above estimates, except for raising the young plants in nurseries in the first instance. If the sowing and planting be carried out and completed as suggested, during the first month of the monsoon weather, no after watering will be necessary. This is an important point, and should not be overlooked. It will otherwise make all the difference, not only in the success of the operations, but also in their ultimate cost.

Having planted the land and sown the seeds, all that will be necessary will be to watch the growth, and prevent the seedlings and young plants from being choked by the grass and creepers, which are certain to appear in the plantations. One or two weedings at intervals of six months, with cultivation of the soil around the young trees and seedlings, will be necessary for a year or two, according to the progress they make; after which they ought to be left to themselves to make their own way up. The ultimate cost of an acre of plantation will then stand somewhat as follows :—

First year under composite system	...	Rs. 30
Second and third years' weeding and cultivation	... ..	6

Or, Total ... Rs. 36 per acre.

If planting alone be carried out, the cost of it, according to what similar plantations have already cost in Mauritius, which cost has much depended on the time and age that transplants were put out at, will be between Rs. 40 and Rs. 45 per acre, exclusive of superintendence; or, say, at an average of Rs. 50 per acre all round up to the period the plantations are fairly

established. It is quite practicable, however, under a well designed scheme, carried out with thrift and economy and on a large scale, to lay out plantations of young trees in Mauritius at a cost not exceeding Rs. 40 per acre. For less it could probably not be done in a satisfactory manner, in a place where the price of labour is double that of some and treble that of other parts of India.

Grand Bassin Block.—Estimated area 5,801·5 arpents. The forests composing this Block are situated at elevations varying from 2,300 to 1,400 feet above sea level. The principal mass of them, however, lie at a medium elevation of 1,900 feet, within the region of maximum annual rainfall which exceeds 140 inches; and they likewise occupy the central southern parts of the table land. Each forest composing the Block is clearly demarcated with stone boundary pillars, marked with the broad arrow, and bearing numbers corresponding to the series in which they stand. The boundary lines are straight and well kept up, being always open, and maintained so by the Forest Rangers in local charge. A complete and comprehensive map, on the scale of 1,000 feet to the inch, has been prepared of these forests by the Surveyor-General, under whose orders the above very satisfactory preliminary works have been carried out. Protection to the forests is also perfect; the Forest Rangers in charge, and who reside in the forests, being men of some intelligence. One man especially, Lebreton by name; is one of the best Forest Rangers of the force, and knows his work, and the local names of the various trees which compose the forests extremely well.

In one of the forests, Concession Dayot, there is also a nice comfortable house which was built by Mr. Horne, Director of the Forests, who lived in it at the time the forests were being worked for the extraction of the dead, dying and diseased trees, which still however to a great extent predominate, and which will have to be removed for reasons which will be shown hereafter in the proper place.

The forest known as "Les Marres," 2,039 arpents in area, and that called Mountain Cocott, 371 arpents in area, are situated on extremely wet and rocky soils; and the forest growth, in consequence, is composed of inferior species of short growth. The Les Marres are extensive marshes, near and around which are chiefly found the "Manglier" (*Sideroxylon Bojerianum*, and its varieties) a worthless tree. On the whole there is nothing of much value in these forests, but they must nevertheless be protected, as from their position they give rise to, and preserves numerous springs which go to feed the rivers flowing towards Savanne and the Black River District.

Forests of Les Marres and Mountain Cocott.

Of the remaining forest lands, one containing 188, and another containing 667 arpents, are not now under heavy wood; but carry a small young growth of various species. The forests of Dayot, Talbot and of Mare Souilliers were purchased recently by the Crown, and for which was paid some Rs. 650,000—the combined area of these forests being some 2,545 arpents. The Mare Souilliers, as its name denotes, is a marsh of considerable extent covered with a worthless forest; the “Manglier” being the prevailing tree. In lower and drier parts the forests are however better, composed of more valuable species, and the growth finer. Parts of Talbot and Dayot, however, contain the best grown Government forests in the Island at the present day; but in which unfortunately are but very few trees, the timber of which is at all valued in the market. In truth these forests owe their present existence to this fact alone. However such species as Tambalacoque (*Sideroxylon grandiflorum*), Colophane (*Canarium Colophania*), Bois d’Olive, (*Elæodendron orientale*), Makak, (*Imbricaria petiolaris*), Natte (*Imbricaria maxima*), Bois de Fer (*Stadmannia Sideroxylon*), Tatamakka (*Calophyllum inophyllum*), some of the larger Eugénias called “Pomes,” and a large timber tree not yet botanically identified, called locally Bois de Sandal, may be met with; none being common, rather on the contrary the best specimens occur in the more difficult ground. It is only in these forests that an idea can be gained of the grandeur and composition of what are essentially known as Evergreen Tropical Forests, and which at one period must have covered, with the densest tree vegetation it is possible to imagine, four-fifths of the area of the Island. The tree-ferns rising to heights of 25 to 30 feet, the countless other Ferns, the Peppers, Creepers and Twiners, the mass of tall clean-stemmed undergrowth, packed so closely together as not to give passage to a man through them, and above all the dense, almost black, shade of these forests, are something to see and to admire. The average height attained by the forest growth is not over thirty feet, but individual trees are not wanting which tower above the mass to a height of fifty to sixty feet, and support, in the forks of their branches, those ferns and orchids which love the light. It is in these huge excrescences formed by these plants growing together in masses that the “Paille en queue,” or Boat-swain or Tropic Bird, the *Phæton candidus* of ornithologists, loves to breed.

As a great part of the forests comprised in this Block are in bad condition, owing to the extensive and injudicious fellings which were carried on in them before they fell into the hands of Government, it will be necessary to restock such portions artificially on which the young growth, now on the ground, is deficient. To do this properly, and to remove the large quantity of dead and dying

trees that abound everywhere, it will be necessary to carry out works similar to those introduced about three years ago in Concession Dayot.

All dead, dying and diseased trees should be removed—great care, however, being taken that the sound and healthy trees are left on the ground.

A plentiful supply of young healthy seedlings of the more valuable indigenous species should be provided in advance of these operations, in order that the restocking of the forest may proceed with the extraction of the old trees. It would be advisable to try here a mixture, with the indigenous species, of the Indian Pine known as *Pinus longifolia*, which at Curepipe has a remarkably vigorous growth. Likewise also *Pinus Kasya* and *P. Merkusii* of Burma; also *Cupressus torulosa*, the seeds of which can be procured from India and Burma; and which are recommended for trial by Dr. D. Brandis, Inspector-General of Forests to the Government of India.

These pines should be put out in the proportion of 1 to 10 of the indigenous species. Planting should be done close, as it is necessary to cover the soil as much and as quickly as possible. The pines will soon overtop the indigenous species, and being in the proportion of 1 to 10 of the latter, will not interfere with their growth, and besides their light open foliage does not throw a deep shade. They are difficult trees to transplant, so care should be taken in that operation.

The nurseries should be established as near to the place where the plants are required to be put out as can conveniently be arranged, at least three years before the forest is worked for the removal of the diseased and injured trees. The nurseries should contain a plentiful supply of young plants of from 2 to 2½ years old, and which should not be put out until they are of that age, as they will then be less likely to be suppressed by grass or be eaten down by deer. These nurseries should be utilized for the rearing of all the stock required, whether composed of indigenous or foreign species. On no account should natural seedlings be brought from the forests, and put down in nursery beds as a preliminary training, as is sometimes done, but the plants should be reared from seed sown in seed beds.

The suggested treatment will therefore consist in clearing off all dead, dying and diseased trees, and restocking the ground artificially, except such portions of it as have already been naturally restocked. Much work of this kind has already been done in the Dayot forests, so that the details of operation are well known, and therefore need not be repeated here.

No regular working of the belts of evergreen forests remaining untouched is possible, except under the system of "selection"; and even that will fail owing to the difficulties of extraction of the timber, and not then without damaging

a considerable portion of the growing forest. Perhaps clear cutting will after all succeed best with them. But it is a treatment which would have to be carefully watched, and carried out judiciously in wide strips, of say 200 feet, over which all growth should be cut and cleared off; and then immediately after the land should be planted over with the more desirable species. A beginning should be made, however, as a tentative measure only, after a good supply of seedlings to transplant have been raised in or near the forest to be cut; a strip should then be marked out in the latter, say 200 feet wide and running east and west across the forest. The trial could best be made at the head of the Dayot evergreen belt. However, as fine examples of the only remaining primeval forests of Mauritius, it is suggested they ought not to be worked for their yield, but maintained intact for their glorious beauty, which surpasses that of all other natural phenomena met with in the Island.

Mountain Range of Grand Port and Flacq.—Estimated area, 4859·5 arpents. These forests are composed of a narrow strip, somewhat wider at the western extremity, covering the above range of hills. Upwards of 2,550 arpents of land, in the eastern parts of the range, remain still undetermined. The forests are composed of species similar to those of the Grand Bassin Block, except that *Tatamaka* (*Calophyllum inophyllum*) and the *Ebonies* are somewhat more abundant—the elevation of these forests being between 1,400 to 1,900 feet above sea level and the rainfall from 140 to 155 inches per annum.

Their present condition is somewhat as follows: In the western parts, where the land has been determined as being the property of the Crown, the forests are ruined, excepting small tracts lying in the inaccessible parts of the mountains which remain untouched. All below have been worked out; what now remains being the dead and dying trees of inferior species. In the eastern portions, which lie entirely in the mountains, the forests are somewhat better; but they are more or less inaccessible, being moreover protected by law from being cut as they fall within the Mountain Reserve Line.

For such portions as lie below the mountains, the treatment ought to be the same as that suggested for the forests of Dayot in the Grand Bassin Block. It would likewise be advisable to try here the Indian *Pinus longifolia* (and other eastern Pines recommended), and some of the Eucalypts intermixed with the better class of indigenous trees. The extension of *Tatamaka* here, however, ought not to be lost sight of.

At present the ground is literally choked with the wide-spreading, trailing, shade-yielding *Rubus moluocanus*, which of course will have to be cleared away before planting out can be done. The plantations here ought to be laid out in lines six feet

apart, the plants standing in the lines at four feet apart, or 1,815 to the acre. Once the young plants start growing it will be advisable to encourage, in every possible way, the formation of a dense undergrowth beneath them.

As regards the forests in the mountains not lying within Reserve Lines, it is only possible to work them on the selection system, provided the cost of extraction of the timber is not prohibitive, but which it will probably be found to be the case.

Piton du Milieu.—The forests consist of a single block measuring 2798·5 arpents, situated at an elevation of 1,600 feet above sea level, with a mean annual fall of 140 inches of rain. The forests are composed of species similar to

5.—*Piton du Milieu.*
Situation, extent and
present condition.

those already described, except that Natta, Tatamaka and Ebony are the prevailing trees amongst the remaining better kinds. These forests have been extensively worked, and are at present in a state of utter ruin, being likewise choked with *Rubus moluccanus* and a considerable quantity of undergrowth composed of non-indigenous species. The larger trees are more or less damaged and diseased by winds and insects.

The same as for Concession Dayot. The dead and dying trees to be removed, and the ground planted over with Natta, Makak, Tatamaka, and other valuable timber-yielding indigenous species which prefer a moist, almost wet, soil. All natural regrowth of such, now on the ground, must be strictly preserved, only the dead and diseased trees being removed. Nurseries and seed beds will have to be established for the rearing of the necessary stock for planting out. These forests are not considered eligible for receiving any foreign species, except the Toon (*Cedrela toona*) which would probably thrive in the damp soil.

Mountain Range of Port Louis.—Estimated area, 3,931 arpents. Situated on the higher slopes and ridges of the Port Louis Mountains; as well as consisting of smaller blocks lying in the Districts of Moka and Pamplémousses.

6.—*Mountain Range of Port Louis.* Situation, extent and present condition.

It is only along the crests and higher slopes that any forest remains, and that is protected by law as the Mountain Reserve. On the whole the growth is fairly dense, but few large trees are to be met with; nor does the composition of the forests in any way differ from others already described. In the lower parts of the mountains, introduced species, now subspontaneous, are common; and which in some parts have reclothed the mountain sides with a fairly dense growth. The *Acacia leucocephala* is now fully established, and overruns the country hereabouts. If not cut down so frequently as it is it would soon grow into small trees 20 feet in height; but since it is in much request as fuel, it has but a poor chance of attaining such dimension.

One of the blocks comprised in this group has an area of 290 arpents, and is the domain on which stands Government House Reduit. His Excellency the Governor, who takes considerable interest in all forest matters, has introduced and reared a large crop of seedlings of the various Eucalypts from Australia. These seedlings are intended to furnish stock for replanting much of the waste land in Reduit, as well as elsewhere. In addition to the large stock of Eucalypts, mentioned above, His Excellency has caused to be raised vast numbers of various other Australian trees, which no doubt will be ultimately of great value to the Colony by their introduction as fast-growing species.

As the principal mass of these forests lie within Mountain Reserves they have been well protected, and will of course continue to receive similar treatment. For rewooding the lower spurs, and the dry waste lands about Port Louis, the treatment recommended in the case of Tamariad Mountain should be adopted. A composite system of planting and sowing for the more level lands, and sowing in horizontal contour bands for the mountain slopes. There should be no stint in seed sown; and when that of several species of trees are sown mixed together, the chances of failure will be much reduced. What ought to be done at once is to organize a smart, trustworthy seed-collecting establishment, under the orders of the Director of Woods and Forests, so that large quantities of seeds of various evergreen and other shrubs and trees be collected and stored in dry places, ready at hand to be sown as soon as the north-west monsoons begin in December. Meanwhile, also, the laying out of the horizontal beds along the mountain sides be commenced in anticipation of a sufficient quantity of seeds being collected. In the appendices to this Report will be found lists of shrubs and trees both indigenous and foreign, which are recommended for trial, both for rewooding mountains, and for planting out in the forests with the view of restocking them with more valuable trees.

For the waste lands of the Reduit Domain, the formation of extensive plantations of Eucalypts is a sound and wise proposal of His Excellency the Governor, which is with a view of giving their cultivation a fair trial in a selected locality; the finest, perhaps, for such a purpose, in the whole Island. These plantations will be laid out in lines, cleared of all undergrowth, six feet wide bearing by north by south-west, so as to leave the present growth on the ground to shelter the young transplants from the cutting effects of the persistent winds which blow from the south-east. The plants in the lines will stand at four feet apart, and there will be an uncleared space of natural young wood of ten feet in width between every two cleared lines. Should

the young Eucalypts show signs of suffering from the want of more light and less shade, the natural growth will be cut back sufficient to effect this purpose, but no more than what will suffice—the ten-feet wide belts of natural growth being left as screens to break the force of the winds.

In addition to the Crown lands, the Surveyor-General has charge of what are called Ouratelle lands, *i.e.*, without any present claimants. There are about 1,684 arpents of such lands under his care. With the exception of one, Contanceau, which lies between Dayot and Talbot, none of the other estates, of which there are six altogether, contain forests of any height, though they are more or less overgrown with young trees chiefly of subspontaneous origin. Should these estates lapse to the Crown, their treatment as forests will be the same as suggested for the other Crown lands.

A very able, complete and exhaustive descriptive account of these forests has already been placed before the Government, by Mr. N. Cantley, Acting Director of Woods and Forests. As none of the private owners, except one or two, appear to have any notion of retaining their forests in their own hands, or otherwise preserving them, it would be advantageous if the Crown purchased these properties with that view. In fact there appears to be no other course open, if they are to be preserved, but to buy them up.

Such of these private estates—all now more or less ruined as regards the forests on them—which appear desirable should be purchased by the Government, and retained in their hands, will be found briefly and concisely described, as regards their present condition, in a schedule annexed to this Report. For more detailed information Mr. Cantley's admirable map and memorandum might be consulted.

It will be necessary before closing this section of the report to say something of the causes which give rise to injury to forest trees and forest vegetation. In Mauritius the young forest growth is liable to be considerably injured by the attacks of *snails*, which not only devour the foliage, but frequently cut back the healthy shoots of young plants. In a plantation near Pamplemousses, in one year the snails destroyed 10,000 young plants. Now the natural enemy of the snail is the *Tenrac*, or Madagascar hedgehog (*Centetes sp.*) In the natural forests, where the *Tenrac* is more abundant than elsewhere, and where it may be seen at all hours of the day hunting about for snails and their eggs, there will scarcely be found a single snail grown large enough to cause appreciable damage to the vegetation. But in quarters where the *Tenrac* is hunted to death for the sake of its flesh by the African Creoles, snails not only abound,

Causes of injury to forest growth. Snails.

but do incalculable damage. On Crown lands the *Tenrac* ought therefore to be a protected animal, just the same as are certain introduced birds. It must not be forgotten that it is on record and uncontradicted that 10,000 young plants, put out in a plantation, were destroyed in a single season by *snails*. The *Tenrac* alone is able to keep these pests down within reasonable limits.

Deer, (*Rusa Tunjuc*) introduced by the Dutch from Java in the higher parts of the Island, do considerable damage to the young growth. In Concession Dayot whole acres of young transplants, of certain species of which they are fond, are found out back. In future operations it will be necessary to take measures for fencing the plantations. Unfortunately the Deer seem to prefer eating such species as *Makak*, *Natte* and *Ebony*, more so than others; the two first yield decidedly the most durable and valuable timber among the indigenous trees.

Deer. These are numerous and exceedingly destructive both to the fauna and flora of the Island; since they devour both the eggs and young of birds which breed in the forests, and whose presence there would otherwise be a check upon the growth and multiplicity of insect life, which is so destructive to timber and forest trees. The monkeys likewise devour and throw down the unripe fruits of all the principal and important forest trees; so that it is scarcely possible to procure ripe seed that will germinate. It will, therefore, be absolutely necessary, in the interest of forest conservancy, to provide the Forest Rangers with the necessary means for destroying or otherwise driving these mischievous creatures out of the forests.

Monkeys (*Macacus cynomolgus*.) These animals are likewise destructive to young plantations in the lower parts of the Island, and are difficult to keep out. They have been found to injure transplants of certain species of introduced Indian origin.

Hares (*Lepus nigricollis*) introduced from Southern India.

Wood-eating insects. Wood-eating insects that in all probability, failing to find sufficient food in the remaining dead and dying trees, they will attack the living ones. In fact, instances have come under observation where this had been the case. It was found to be the case with some living trees of *Eugenia glomerata* in the forests of Concession Dayot. And was, likewise, observed to an alarming extent in the valuable forests belonging to the Honorable F. H. Pitot above Bois Sec. In these forests, the origin of the mischief appears to have been due to the too sudden opening out of the forests, by heavy fellings and clearings, by which a large gap was created. The trees, standing on that side immediately exposed to the violence of the strong and persistent winds which blow in that quarter, began to die off; and thus gave shelter and

nourishment to various species of wood-eating insects, such as are comprised in the family *Bostrichidae*, as well as various *Bark Beetles*, belonging to the genera *Scolytus* and *Tomicus* of the family *Scolytidae*. The attacks of these insects soon killed the trees, which, dying off completely, exposed the next line of trees, immediately behind them, to bear the brunt of the strong winds. In time these also became weakened, losing health and vigor, and were thus prepared to receive the swarms of wood-eating insects, which had now multiplied considerably, and by which they were, in their turn, completely killed off. And so on, doubtless, has run the course of this now serious calamity. In these forests may be seen large trees, (*Calophyllum inophyllum*) of magnificent development, entirely killed; and as far as could be seen of it, the evil was gradually, but too surely, spreading onwards and upwards into the hill forests, where to end it is hard to say. In the forests, lying above the immediate line of attack, were found young and comparatively healthy trees of various species, in which were discovered swarms of beetles and their larvæ, and which appeared to belong to the genus *Tomicus*, though to what species we are unable to say owing to the want of books of reference. These appeared, as it were, the pioneers whose first attacks would shortly be followed up by the more robust *Bostrichidians* coming up in the rear.

There are, besides the foregoing mentioned, numerous other species of Coleopterous insects, whose larvæ feed on the woody stems of trees, especially such as have received injury, or the health and vigor of the trees have otherwise been impaired. Such insects belong to the families *Buprestidae*, and the long-horned or capricorn Beetles (*Cerambycidae*), all of which are represented in Mauritius by several genera containing numerous very fine species.

Before concluding this notice of the more prevalent forms of insect life capable of inflicting grave and serious injury to the forest growths of Mauritius, a word might be said on the necessity there is for affording all the protection the law can give to the insect-eating birds, whose presence in the forests, though few they be, doubtless has an appreciable effect in reducing the number of insects which might otherwise complete the cycle of their existence. Of insectivorous birds there are but very few in the Island, and which belong to some half dozen species.

These are very abundant, attacking decayed and decaying timber. They belong to species which differ from the Indian forms, by constructing their galleries and globular nests with decayed wood, and likewise arboreal in their habits. The huge globular excrescences, so frequently met with on decaying trees, are the habitations of these creatures.

Preservation of insect-eating birds.

White ants.

The timber is very liable to the attacks of *dry-rot* and other fungoidal forms which cause considerable destruction to it. Very few of the larger mature trees, now met with in the forests, are free from *dry rot*. In fact it is the rule rather than the exception to find timber attacked by it. Once commenced the destruction goes on, unless the diseased part be carefully cut out so that none of it remain, otherwise the *fungus* will again spread. The climate of Mauritius is peculiarly favourable to the development of such parasitical *fungi*, several forms of which likewise appear on the leaves and twigs of living trees.

Micro-fungoidal diseases.

Creepers and Epiphytic plants of large size are not numerous, and therefore are not active agents in effecting any appreciable damage to the forest trees. Two climbers of robust habit, however, are found within the forest regions—the *Cnestis globra* and *Roussea simplex*, but their occurrence is rare. Amongst the herbaceous twiners are several species which damage the young growth, and which will require attending to in all newly formed plantations. Of *Epiphytes*, capable of injuring fully developed forest trees, may be cited the several species composing the genus *Ficus*. These are likewise not of common occurrence, and therefore the injury they do is inappreciable, though it would be well to make it a standing order to all Forest Rangers that Creepers and Epiphytic plants of destructive habits, wherever met with, should be killed. This will be done by cutting off the stem, in the case of a creeper, close to the ground, and then splitting and smashing up the stump to prevent its shooting out new stems. *Epiphytes* may be cut down and removed if they are in a position where they can be got at. Each Forest Ranger should be provided with an axe of the kind common in Mauritius, having a chisel-cutting edge at one end and a hammer head at the other; without his axe in his belt no Forest Ranger should stir out on his rounds.

Creepers and Epiphytes.

These are very destructive in Mauritius, because of their persistent action whenever they set in blowing, which is in winter from the south-east quarter; they then constitute what are called the south-east trade winds. In all exposed localities tree vegetation suffers considerably from them; they are cold and cutting, and as they blow with some force, amounting sometimes to continuous gales, the damage they do in cutting over and retarding growth is considerable. In some parts of the Island this is especially the case; and it will be observed that, owing to these winds, the branches of trees exposed to windward have become arrested in development, and that growth has taken place on the opposite side instead, thus rendering the trees lop-sided. The

Winds.

effect of such growth, on the timber produced by such trees, is that the fibro-vascular bundles of woody tissues, instead of being regularly arranged in concentric circles around the stem, are formed in excess on the sheltered side of the tree, while similar bundles on the windward side are few and imperfectly developed, so that the timber of trees grown under those conditions is less valuable, where strength and durability are requisite qualities. The force and persistency of these winds during a great part of the year also cause the taller forest trees, which, seeking the light, force themselves above the general canopy of forest foliage, and in which situation they are then exposed to the full action of the winds,—to throw out buttresses, and their stems are thereby rendered irregular and of fluted formation. The stems of such of the taller trees, as *Tambalacogue*, *Colophane*, *Tatamaka*, *Natte* and *Makak*, are familiar examples.

In all instances where young plantations are to be established in localities exposed to these winds, shelter belts against winds. shelter belts must be first established, placed at right angles to the direction from which they blow. Such belts are easily formed, and may be twenty feet in width, planted with *Casuarina*, *Telfaria*, (*Tetranthera monopetala*,) Bamboos, *Jamlongue*, (*Eugenia Jambolana*) or some of the quick growing hardy Australian trees. Unless such protection belts are first established, it is very doubtful; otherwise, if laying out plantations in such localities is not literally throwing money to the winds.

These sometimes visit the Island, and may appear at any time between 1st December and 1st April; Hurricanes. the destruction caused by these revolving storms are simply incredible; all tree vegetation, sugar plantations, orchards, in fact everything offering any obstacle or resistance, go down at once before them. No forest, unless growing together in a compact mass, could withstand them. Hence the necessity, whatever is done artificially in the way of getting up young forests, to plant thickly and to allow no room for these winds to find a way into them.

(To be continued.)

Rate of growth of Sal in Chota Nagpore.

ON a recent tour through the forests of Chota Nagpore, the opportunity was taken to measure S&l trees wherever possible, with a view to ascertaining the average rate of growth. The best countings were obtained in the Singbhum Forests in a portion of the Anandpur Estate, which the Thakúr was working for timber to build the new jail at Chaibassa. Careful countings were made on eight stumps with the following results :—

No.	Girth with bark.	Thickness of bark.	Mean diameter, wood only.	Age.	No. of rings per inch.
		in.	in.	years.	
1	8' 6"	1.25	29.5	122	8.8
2	8' 6"	1	26.5	116	8.8
3	6' 0"	0.75	21	72	6.8
4	6' 10"	1	23	120	10.5
5	6' 6"	1	21.5	93	7.8
6	...	...	22	100	9.1
7	6' 5"	1	22	93	8.5
8	7' 8"	1	24	115	9.6

giving an average rate of growth of nearly 8.7 rings per inch. The rings on the clean cut section were particularly well marked for S&l, and the stumps recorded presented no difficulty in counting. Many more stumps were really examined, but the measurements were not recorded where in the least doubtful.

No. 1 gave the following measurements for the different thickness of 10 to 10 rings, counted as the greater radius only. Owing to indistinctness on some radii the mean radius measurements were not procurable. These measurements show a comparatively uniform growth :—

Yrs.		Yrs.	
10	1 1/2	80	1 1/2
20	1 1/2	90	1 1/2
30	1 1/2	100	1 1/2
40	1 1/2	110	1 1/2
50	1 1/2	120	1 1/2
60	2 1/2	122	1 1/2
70	1 1/2		
		Total	17 1/2

In the same forest the following measurements of a log 50 feet long were recorded :—

Girth at	Feet.	Inches.	Girth at	Feet.	Inches.
...	0	114	...	30	86
	5	101		40	83
	10	88		50	78
	20	86			

This shows a decrease of 23 inches in 45 feet, from 5 feet to 50 feet, or omitting the first ten feet, where the trunk evidently broadened out—10 inches in 40 feet, or 1/4 inch decrease per foot of height. Above 55 feet a big knot unfortunately prevented further measurements. To show the size to which

timber in the magnificent Saranda Forests can attain, the following measurements of a big tree may be given :—Height, 125 feet; girth, 121 inches, and this was not a very exceptional case. In the adjoining Government Reserve no large fellings were going on, but the following smaller trees were cut and measured—

At Rongo on the outer Western Range of the Saranda hills :—

	Feet.	Radius.	Rings.	Rings per inch.
On the hill ridge in a dry place, exposed to hot winds (C. 3,473) about	1,500	2 in.	24	12
At the foot of the hill, locality comparatively moist (C. 3,473) at about ...	1,000	2½ „	18	7.2

On the slopes of the Ankua hill overlooking the Koina valley :—

	Feet.	Radius.	Rings.	Rings per inch.
On the summit	2,700	2½ in.	17	7.5
(The age of this is known, for the place was cleared in 1863 for a survey point.)				
On the northern aspect slope, good soil, laterite	2,000	3½ „	29	7.7
On a western aspect, rock laterite, but very little soil over it	1,800	4 „	62	15.5

These three specimens have been kept and marked C. 3478, C. 3479, and C. 3480 of the Dehra Dún collection. On the hill above Kurkutia in the Kolhán Forests a sapling, or rather shoot, was measured (No. C. 3490), giving 1½ inch radius to 9 years of growth, or 8 rings per inch of radius.

These measurements seem to show that the rate of growth of Sál in Saranda may be taken to be 7 to 9 rings per inch of radius for trees growing on good soil in sheltered localities, and 12 to 15 rings for trees growing in more exposed conditions. For good soil, therefore, we may consider 80 to 100 years as the age at which Sál may be expected to reach 6 feet in circumference, exclusive of bark.

In the Palamow Forests, which are all young and chiefly composed of stump shoots from saplings which have been constantly cut over while yet young, before the forests were reserved, a few countings were also made with the following results :—

Forest.	Radius.	No. of rings.	Rings per inch.
Kumandi Reserve (C. 3434)	½ inch.	6	7
Chanpi Forest (C. 3441)	3½ „	23	7.5
Seemah Reserve, Neturhát (C. 3440)			
3,000 feet	2 „	20	10
Seemah Reserve, Henar Valley (C. 3444)			
Shoot 33 feet high	2½ „	10	4

These show that, at any rate, at first the growth of shoots is fast if the locality is favourable, and that even at 3,000 feet on the laterite of the Neturhát plateau, the growth is not bad considering the conditions. That large timber can be grown in Palamow is evident from the measurements of old trees on

the Jaigir plateau at about 2,500 feet in a sacred grove. These trees showed a height of 100 feet to a girth of 10 to 11 at 4 feet from the ground. In estimating, however, the probable growth of Sâl in Palamow, it would be too much to count on an average of even 7, much less 4 rings per inch, and it will be safer to take the probable age of trees at 6 feet in girth as about 80 years in good, 120 years in moderate, and 150 years in exposed and high localities. In Chota Nagpore the effects of forest, especially in low-lying spots, just below the hills, are very remarkable. In the Seemah Reserve whole areas of young Sâl forest, evidently of promising growth, are often thus destroyed. But in more exposed places, frost is seldom very destructive, and it would seem that, in Palamow at any rate, it is only the low-lying moist places near to high hill ranges, which are much affected.

The counting of annual rings on freshly cut stumps in Chota Nagpore is by no means difficult, but the markings of the annual rings seem to disappear as the wood cut seasons or the stump gets older, and it is then difficult to say always what are annual rings, and what are only lines containing fewer or more pores, but not marking annual growth.

J. S. G.

On the Restoration of Denuded Forests in Kolhapur.

On looking over the map of the Bombay Presidency it will be seen that Kolhapur is a Native State, situated on the range of the Sahyadri Mountains, and bounded by the district of Sattara on the north, and by that of Belgaum on the south. It is ruled over by a Mahratta Chief, a descendant of the great Shiwaji, the founder of the Mahratta rule in the Deccan. The present Chief being a minor, the affairs of the State are managed by a Native Karbhari (minister) under the general supervision of the British Resident.

The total area of the Kolhapur State is about 3,000 square miles, and the revenue is about 30,00,000 rupees, including that of the subordinate jaghirs. The country is intersected by long ranges of hills, branching from the Sahyadri (Western) Ghats, and running perpendicular to it in the east. These hills form the water-parting of the several tributaries, which take their rise in the Western Ghats, and empty themselves into the celebrated Kistna river, supplying water for irrigation for a considerable area of land under sugarcane cultivation in the rich valleys through which they run. The importance of protecting the tree vegetation on these hills and on the slopes of the Ghats cannot, therefore, be denied.

The State authorities, having been quite alive as to the necessity for immediate action in that direction, obtained the services

of a native forester from the Bombay Forest Department, and with his advice introduced a system of forest management both in the interest of the State and its people; gradually, though steadily, introducing reforms as the people became reconciled with the altered circumstances.

The Forest Department was started in March 1878, and subsequently organized in November following, after the forests were fully inspected, and their capabilities ascertained by the Forest Officer. The Department at first employed itself on the most important and preliminary work of forest demarcation, which has since made considerable progress.

Simultaneously with the forest demarcation, the Department was authorized to bring certain forest areas under strict protection, and to provide for the maintenance and improvement of the reserves; and, though little progress has yet been made in that direction, it is nevertheless satisfactory considering that the Department is in its infancy, that the new staff of subordinates have to be taught and initiated into the rudiments of forestry, and that they have to acquire, by experience, a knowledge of the cultural requirements of at least some of the important forest trees.

At the outset, it must be said that the object of the State Forest Department is not to create ornamental plantations by incurring a large outlay, but simply to undo the mischief caused by recklessly cutting down, and afterwards burning the first jungle trees and vegetation for kumri (or what is otherwise called dhaya) cultivation and for other purposes; by re-clothing the bare hills, or large open blanks in the forest reserves with anything that will grow on them, so as to prevent the consequences which may be expected to arise from denudation. Nevertheless it is desirable to grow valuable timber trees so as ultimately to supply the market with timber. At the same time the cultivation of fruit and other useful trees yielding valuable minor produce, such as myrobalams, lac, gum, &c., has not been neglected, as they would not only considerably add to the resources of the State, but would afford employment to the poorer and wilder classes, who are solely dependent on the produce of the forests for their maintenance; but that, too, seems at present to have denied to them by Providence, which punishment they deserve for carelessly and recklessly destroying all vegetation near about the place of their abode.

When first creating the forest, jungle trees and vegetation, it seems as if nature were cognizant of the wretched condition of the poorer classes residing in the remote corners of the country, and encouraged, and gave, as it were, a prominence to the growth of such species of tree as would have (if they had been spared) provided in the shape of edible fruits, roots, flowers, leaves, &c., for the requirements of the

people, whose indolent habits precluded them from adopting a better mode of cultivation than the well known and pernicious system of kumri.

For instance there is a variety of climber called "Kusar," (*Jasminum arborescens*) formerly to be seen everywhere on the line of the Ghat Forests, but now gradually disappearing. It flowers in March, and immediately afterwards commences to bear, and is loaded with seed in such quantity that it supplies food to at least three-fourths of the population residing near the Western Ghats. The noteworthy fact in connection with this climber is, that its boiled seed is said to be as nutritious as any of the common food grains produced in the Mawal country, such as *wari*, *sawa*, &c.; besides, while quenching the appetite, it is considered by the hill people to be a cure for any derangement in the stomach. On account of this good quality, the people eat it after boiling it several times to make it palatable, as it is bitter in its raw state. There are other varieties of vegetation affording similar means at other times of the year; but it is needless to describe them all here—suffice it to say, that about three-quarters of the population near about the Ghats subsists on the produce of the forests for about six months in the year.

The above fact was, therefore, laid at heart by the Department in conducting the sowing and planting operations wherever the capacity of the soil operated upon permitted of its being observed.

Four different methods, viz., broadcast sowing, sowing of seeds by dibbling, direct sowing in pits and seed holes, and raising of seedlings in nurseries for planting out, were suggested for adoption in replenishing the denuded hills with jungle trees and vegetation; but how far each succeeded in securing the object in view is to be gathered from the result herein recorded.

During the past Fuslee year, that is during the rains of 1879, small nurseries were established in different localities, mostly to raise Teak and Bamboo seedlings for subsequent transplanting; but the cultivation of other useful trees, such as Amba (*Mangifera indica*), Fanas (*Artocarpus integrifolia*), Bhendee (*Thespesia populnea*), Oondee (*Calophyllum inophyllum*), Chandan (*Santalum album*), &c., on a small scale, was by no means neglected.

The Bamboo and other seeds germinated after they were put into the ground, but the Teak, as was sown in its natural state, took one complete year to come up, so that it came up thickly when the regular rains of 1880 commenced to fall.

The Teak seedlings, as soon as they had borne six leaves, exclusive of the cotyledonary ones, which was by the middle of July last, were, as well as the seedlings of other plants one

year old, removed from the nurseries, and transplanted, as shewn below, during the monsoon of 1880 :—

Name of the Sub-division in which the Reserves are situated.	No. of Plants.		
	Teak.	Other kinds.	Total.
1. Kurweer	26,000	600	26,600
2. Bowda	8,000	1,000	9,000
3. Bhoadagad	7,000	...	7,000
4. Panhalla ... ..	...	400	400
5. Malkapur	3,000	400	3,400
TOTAL	44,000	2,400	46,400

The smaller and tender plants which sprouted up later were retained in nurseries for removal in the following year.

The bamboo plants had grown four to five feet in height, and were quite capable of being planted out during the last rains ; but as no bamboo seed could be procured for sowing during the current year, it has been considered desirable to retain them in nurseries until the rains of 1881, when they will be able to throw out new shoots from the main stock. These shoots it will probably be possible to separate, so that they may be planted out separately, and thereby increase the number of bamboo seedlings to at least double the present number.

The approximate number of bamboo plants now growing in different nurseries is 11,000, and these will be available for transplanting at the commencement of the rains of 1881, and by the end of that monsoon season they will, it is hoped, have taken a firm hold of the ground, and be in a position to stand better against the dry summer heat without watering, than would have been the case with tender and younger plants, such as they were during and before the rains of 1880.

The broadcast sowing was resorted to in replenishing the narrow belt of the forests, lying along the Sahyadri Range, which, though irregularly stocked and opened with large blanks here and there, is still capable of being regenerated by self-sown seedlings, provided the seed is scattered over broadcast, or dibbled into the ground, wherever required, to assist the natural reproduction.

The information as regards the area sown under the above system during the past two years, viz., 1879 and 1880, is contained in the following table :—

Year in which the sowings were effected.	Approximate area operated upon in acres.
In the rains of 1879	4,700
Do. do. of 1880	3,200
TOTAL	7,900

The sowing in all the reserves taken in hand in the year 1879 had to be repeated, and it will have to be continued in some until the whole area is thickly covered with new growth.

The result of the sowings effected during the last and the current year is very encouraging in localities where the young forests could be saved from being burnt over, especially in the case of Bowda, Katalee, Shengaum, and Nishnap reserves, which need not be sown any longer, but require to be protected from fire and cattle only for some time.

The change which has been made in the appearance of some of the Ghat Forests, since they were subjected to a regular treatment, is conspicuous even to a casual observer.

There the Hirda (*Terminalia Chebula*) trees naturally abound, and as they are likely to yield a handsome yearly revenue to the State, the Department was induced to put several cart-loads of myrobolams in the ground, resulting in the sprinkling of a new growth of Hirda in all the reserves, and more especially in those of Shengaum and Guzapur.

In a locality further east, outside the above belt, where the hills have become perfectly bare, the ground for sowing and planting had to be prepared a little more elaborately than was the case in the western part of the district. Here the simple method of sowing in pits and seed holes was followed with great success.

As usual the Teak seed that was put into the pits before the commencement of the rains in 1879 germinated only on the setting in of the monsoon of 1880, as has been the case with nursery sowings; and at present about 75 per cent. of the pits contain one or more seedlings. The seeds in other pits are likely to sprout hereafter. Some time must, however, elapse before the result of the direct sowing can be compared with that of transplanting, and we are able to decide which of the two systems can be adopted with most advantage.

Of the Teak transplants put out in the rains of 1879, 40 per cent. have survived without watering. They are now growing six to twelve inches in height, and appear to be sufficiently robust to warrant a hope that they will push ahead without further assistance.

As the Teak in its natural state does not grow alone, it was intermixed with other species of a hardy and fast-growing character, such as Khair (*Accacia Catechu*), Jambul (*Eugenia Jambolana*), Palas (*Butea frondosa*), Wehela (*Terminalia belerica*), Siras (*Albizia Lebbek*), Koombha (*Careya arborea*), Kajoo (*Anacardium orientale*), etc.

Almost all of the above plants dried down during the hot season, and the forest subordinates, who were not familiar with the habits of different trees, felt at first discouraged at what appeared to them a complete failure of their sowing operations. It was, however, explained to them that certain trees have the properties of throwing out new coppice shoots from their roots,

and that many of the plants, which they found to have been killed by frost or extreme heat, would spring up after the setting in of the monsoon. Of course precautionary measures, such as loosening the surface soil and covering it with grass and weeds during the dry season, were required to be taken to prevent the soil drying too much, and to prevent the evaporation of the subsoil moisture.

In the month of June last the plants, which once seemed to have died, began to throw up new shoots to the astonishment of all the forest subordinates, and in the month of August last it was found that about 25 per cent. of the whole number of plants other than Teak have finally succeeded, and this is no doubt a very satisfactory result when it is remembered that the sowings were effected on a poor soil and that the plants were not irrigated.

Among the species selected as companions for Teak, Kajoo (*Anarcardium orientale*) seems to be deserving of every attention for sowing in the forests. It is said to be a native of Brazil; but it is now quite naturalized in all parts of the Southern Konkan, where it is cultivated in groves near the towns, and round about the village temples. It is stated in the Bombay Flora that the wood is much used in France for fine cabinet work, under the name "Bois d' Acajou," though it does not seem to be in use here in carpentry.

The tree bears sweet smelling flowers succeeded by pea-shaped fruit of a yellowish red colour. A fine spirit is prepared in Goa from the fleshy peduncle by distillation. The nut hangs at the end of the fruit outside, and is about an inch long. It is edible and wholesome when roasted, and forms an article of trade and commerce. It is said that these nuts are used for imparting a flavour to Madeira wine, and that they are also known to yield, by expression, an edible oil equal, if not superior, to almond oil, and certainly by no means inferior to the ground-nut oil.

The pericarp of the nut produces a black acrid oil, which possesses caustic properties. This oil is applied to timber to prevent the attacks of white ants.

An astringent gum is exuded from the trunk of the tree to the extent of five to twelve pounds annually, which require to be collected when the sap is rising.

It is said that it forms a good varnish, and is peculiarly useful where the depredations of insects require to be guarded against. It is said that in South America book-binders wash books with a solution of it in order to keep away moths and ants.

Apart from its being useful as above described, the tree appears to be well adapted for cultivation on dry stony ground on account of its fast growth and hardy character. Five hundred seed grains were, therefore, procured and dibbled into the pits and seed holes at the commencement of the monsoon season of 1879.

Almost all the seeds germinated within a fortnight, and by the end of October following the plants had grown up from one to two feet in height, and so firmly established themselves by striking deep roots, that I find the percentage of casualties, even under unfavorable circumstances, is very small indeed compared with other species similarly situated.

The subjoined statement will exhibit the area taken in hand during the current year for direct sowing in addition to that sown over last year, and the number of pits and holes prepared for the purpose in different places :—

Name of the Sub-division in which the Reserves are situated.	AREA OPERATED UPON		Approximate number of plants now surviving from those raised in 1879 after deducting the casualties.	Number of plants grown in 1880.	REMARKS.
	In 1879.	In 1880.			
	Acres.				
Malkapur ...	250	100	19,500	73,480	The casualties among the plants grown in 1880 will not be actually known till after the setting in of the next monsoon.
Bowda ...	250	50	18,000	40,000	
Kurweer ...	210	175	21,000	80,600	
Panhala ...	410	130	30,500	90,500	
Bhudagad ...	15	250	2,000	96,500	

The seeds selected for sowing in the above pits and holes during the year 1880 were the same as last year, and in the same proportion, with the exception of Kajoo nuts, which were used in large quantity this time. Four hundred thousand Kajoo nuts were put into the ground just before the advent of the last rains. They came up luxuriantly as usual, and the seedlings have now attained a height of from twelve to eighteen inches, and promise to grow with vigour.

If the cultivation of the tree in question be continued for a further period of ten years on the same scale as has now been adopted, and if the Department succeeds to grow at least one hundred thousand trees every year, allowing 75 per cent. for casualties, etc., that is 25 per cent more than has been found by the experience of last year (but this has been done more for being on the safe side) while estimating the future yield, there is every reason to believe that, while on the one hand the cultivation of *Anarcardium orientale* will lead to augment the resources of the State forest revenue by the sale of its produce to a considerable extent like the Hirda nuts, on the other it will cover the present naked hills with vegetation, perhaps unequalled as far as beauty and productiveness is concerned, for the tree is very ornamental in appearance, and its cultivation easy.

Considering the tree is both economically and commercially useful, the Forest Department will be justified in estimating that each tree will at least yield, even under unfavorable

circumstances, four annas worth of produce, consisting of, as has been said before, nuts, oil, fruits, gum, etc.

It appears that the cultivation of the Cashew-nut tree was never tried on the barren hills in the Deccan, and there is every reason to believe that this is the first time that it has been tried for forest planting with such considerable success as to warrant further experiments being made.

One noteworthy fact to be kept in view in connection with the Cashew-nut tree is, that it bears fruits and nuts at the age of five or six years, so that any speculation formed as to the value of its yield must take into consideration the probability of such yield commencing at an earlier age than is usually the case with most trees.

It is no doubt desirable that, wherever extensive planting operations are to be undertaken, it is better to adhere to the system of direct sowing of seeds in pits and seed holes (even in the case of teak sowings) on spots where it is to grow into a tree than to raise seedlings for transplanting; but at the same time it must be remembered that it would be undesirable to do away with the nursery system altogether, until the results of the two methods could be compared so as to be able to lay down a definite plan for future operations.

However, the experience gained last year having shewed a tendency to confirm the above opinion, an attempt is being made to gradually abandon the nursery system, instead of giving it up all at once, for the reasons already stated. Four new small nurseries were, therefore, established during the rains of 1880 to secure plants for planting out during the ensuing rains, in which Teak, Chandan, Funas, and *Pithecolobium Saman* seed have been sown.

A few *Pithecolobium Saman* plants, which the Forest Department raised in bamboo baskets in the beginning of the monsoon of 1879, were transplanted during the rains of 1879. Some of these have grown to a man's height during the course of one year, while the remainder were twice browsed down, and in one or two cases broken off by village cattle who had entered the plantation at night soon after the plants were put out. The cattle were seized and put into the cattle ground, but the growth of the plants was retarded by the injury done to them. They threw up fresh shoots with renewed vigour immediately after the setting in of the rains of 1880, and are now growing capitally as if to make up the loss.

The aggregate expenditure incurred on account of the above undertaking amounts to Rs. 3,225, which sum would appear very small indeed compared with the result obtained; but it should be stated that a considerable portion of the work was done by the members of the regular subordinate forest establishment, and hence the small extra outlay.

NATIVE FORESTER.

Jhand Coppice.

TO THE EDITOR OF THE "INDIAN FORESTER."

SIR,—In Ribbentrop's "Hints on Arboriculture," at page 121, it is remarked that in the extensive private rukhs between Meean Meer and Okarah, the roots of the "Jhand" trees are all stubbed out, which apparently, the author thinks, is a very heinous offence to judge from the withering sarcasm of the following sentence, *vis.*: "It remains to be seen if he (the contractor) will succeed in exterminating the long suffering Jhand and Karil." Again lower down on the same page, the author says: "Coppice treatment, aided by artificial cultivation, is the best way to reproduce it." Would he be surprised to hear that the idea is gaining ground among forest officers that the stubbing out of the stump is the proper way to treat Jhand, as by that means not only is a larger supply of wood obtained (the natives have a saying that a Jhand tree gives more wood below ground than above) from the area, but the reproduction is both stronger and greater in quantity of shoots than is the case when the stumps are left in the ground?

I have carefully watched the effects of both systems during this winter, and have decidedly come to the conclusion that the common village "dustoor" is by far the best way to treat Jhand. The villagers cut down the tree and then stub the roots out, not even taking the trouble to fill up the hole left by the process. The consequence is, that water lodges in the hollow, and the ground being kept moist so much longer, the shoots are much more vigorous and healthy than those from a stump would be.

So far has the idea gained ground that experiments have actually been made in a Government (Forest Department) rukh in exactly the same way as is done by the apathetic villager; and, as far as they have gone, are a complete success—the root shoots being in every way finer than those from the stump.

I also observed that wherever land had been cleared for cultivation, the roots being stubbed out for the purpose, there was positive difficulty in keeping down the root shoots, the breaking up of the soil and protection from grazing resulting in a fine crop of the healthiest Jhand shoots to be seen. Of course it would be too expensive for the Department to plough the land, but this treatment was certainly followed by wonderful results.

It is not the custom everywhere for the villagers to stub the roots out. In parts of the Lahore district, to the west of the Ravi, I observed that the trees had been merely felled to the level of the ground. I did not think the coppicing was nearly so good as from roots in other places. However, be this as it may, there is no manner of doubt that nearly as much wood

as was taken from the area was left on the ground, and to no purpose, as the coppicing would have been better in my opinion had the stumps been taken out. I asked why they had been left, and was gravely told that the labour would be so great as to leave no margin for profit, and yet in other parts it is always done, and for a very good profit too.

At the Changa Manga Plantation also, the roots of the trees (Shisham) in Compt. No. 1 (which is being cleared) are being stabbed out, and it is suggested to leave the holes open as in the village lands. Such are the changes years have brought about—since the “Hints on Arboriculture” were written, and the ruthless contractor held up to the scorn of nations.

PANJABI.

In Apology for Salai.

TO THE EDITOR OF THE “INDIAN FORESTER.”

DEAR SIR,—There are few experienced members of the noble Corps to which you belong, who have not seen me, if not every day, at least much oftener than has been agreeable to them; and yet (I say this without any malice, although, with us trees as with you men, revenge is sweet) how many have taken the trouble to know me?

Botanists call me *BOSWELLIA THURIFERA*, *le monde vulgaire* SALAI, SALL, SALAR, GUGGAR, &c., according to the various Indian districts which I have chosen for my habitat. I am not beautiful, or graceful, or majestic. No painter has yet put me into his landscape; no poet has yet immortalised me in song; no whispering lovers meet underneath my gaunt, prosaic, light-admitting boughs; no weary noon-day traveller seeks the shadeless shelter of my leafless crown; no omniscient Deputy Commissioner or ambitious Canal-wallah, those Titans among arboriculturists, have yet considered me deserving of the dignity of a place in their world-famed groves and avenues. Few, oh few! climb the dry, sunny, rugged, spear-grassy hills, which almost alone I inhabit, from a pure sense of duty, for the public weal; occasionally, indeed, I see the mighty hunter, whose thoughts are, however, too busy with weightier matters to take more than a passing notice of me.

In short, dear Forester, there is no tree anywhere in this wide, wide world, that has been more roundly abused than poor me. How many benignant tempers have been lost; how many high hopes, above which rose piles of shining rupees, have been dashed down to the earth at the sight of the miles upon miles of uplands and ungrateful rocks, which I now cover and protect to prepare for a higher destiny in the future!

Your Inspector-General, whose name would be an ornament to any service (may his shadow never grow less), says that my wood is—" (1), *light coloured, darker when seasoned*; (2), *soft*; (3), *spongy*; (4), *coarse*; (5), *open-grained*; (6), *30-35 lbs. per cubic foot*; (7), *not durable*." In this long indictment I plead guilty only to counts Nos. 2 and 7. The carpenter, and especially his tools, will not condemn me on the former count, and as regards the latter, I stand convicted with a host of the most respectable among my sylvan compatriots. But more on this point by-and-bye.

With respect to the first count, I do not deny that my sapwood, like that of the Teak, Blackwood, Sissoo, Hardwickia, &c., is extremely light coloured. But my heartwood (real undecomposed heartwood, not the black deoxydised heartwood of which my friend, the Ebony, furnishes the most striking example) is a dark greenish-brown, of nearly uniform tint throughout. My growth is rapid, and my heartwood begins to form very late; and hence, until I attain what, for me, is an advanced age, *viz.*, from 50 to 60 years, my trunk consists chiefly of sapwood. Thereafter the proportion of heartwood constantly increases, and by the time I am mature, the ring of sapwood in my trunk may be reduced to only one inch, but more commonly two inches.

Counts 3, 4, and 5 will be best answered by coupling them together. A spongy substance is, I imagine, one that is full of plainly visible air-cavities, and that may be compressed with very little force; but you would require a microscope to see any air-cavities in my heartwood, and the man must be gifted with superhuman strength who could, without the aid of machinery or a hammer, compress a piece of my heartwood to any extent appreciable with even the most minutely divided micrometer. After this it would be superfluous to say that my heartwood is *not* open-grained. But perhaps it is coarse-grained. If it be so, then the heartwood of my distinguished friend and colleague, the Teak, is also coarse-grained.

As regards the weight of my heartwood (count No. 6), the only reason I can assign for Dr. Brandis's low figures is, that the experiments, from which they were obtained, must have been made with very dry sapwood, out of which most of the substances naturally impregnating it must have been washed out.

I have already admitted that my wood is not durable, but this admission will be misunderstood without some limitation and explanation. White ants attack my sapwood, but it is not quite so certain, indeed it is doubtful, whether they will touch my heartwood, which emits a very strong disagreeable odour characteristic of it. My human friend, who is transcribing this letter under my dictation, says that he once left a plank of my heartwood for several days, aye weeks, over a large

nest of white ants, who carefully avoided it. A large log furnished by me was cut in the Punasa Reserve in December 1873. It lay in the forest where it fell until October 1874, when it was sawn up into 1-inch planks. The sapwood was then slightly decayed, but the heartwood (14 inches at its greatest width) was intact and still very green. Two months later some of the planks were used in making a table. Although they then appeared perfectly seasoned, still on merely scraping off their surface, they were found to be as damp as if the tree yielding them had only just been felled. By July 1875, the planks in the table had shrunk about 3 per cent. across the grain, and had to be joined anew and planed even at the joints. The plane showed that the wood inside was as green as ever. Briefly, they were not seasoned through even in 1879. Seven years is a long time to require for seasoning, and I confess that this is a very serious defect. Nevertheless the fact remains that after more than seven years those planks are as sound as ever, and are likely to continue so indefinitely.

But you will ask what all this proves? The durability of planks put into a table and kept under a roof is nothing surprising. Quite true, dear Forester; but if you will have patience, you will have more convincing proofs. The life of a thin Teak rafter (all sapwood of course) in a roughly thatched roof is about 20 years; a similar rafter furnished by me lasts at least 5 years. In a tiled roof of the native pattern the Teak will be serviceable for from 30 to 40 years, the Salai from 10 to 15 years. When you remember that Teak is a veritable king among trees, knowing few, if any, equals, I do not show so badly after all in the above comparison. Will my corresponding acquaintance, the Silver Fir, who makes half the forest wealth of France, compare as favourably?

In the Nimar District of the Central Provinces—thanks to a wise, far-sighted forest policy—the inhabitants have now begun to appreciate my usefulness. Five-sevenths of the huts in villages are roofed with wood furnished by me. In the Indore State the storeys of a great many of the new houses in the towns are floored with my planks, although Teak there is not, as with us, a reserved tree. I also supply door-leaves for a large number of houses of moderate pretensions. The cases in which Malwa opium is exported are also furnished by me. In West Berar in the Purna valley my value is still further prized. I command a ready sale as soon as I have attained an average girth of 12 inches, and in some of the forests there my very existence will soon be threatened, unless timely measures are taken to protect me also like my more favoured companion—the Teak.

So far I have dwelt on my already approved value as a building wood. A very energetic friend of mine and an accomplished engineer, Mr. James Carey, Chief Engineer to

H. H. of Indore, maintains that I would make good railway sleepers, if impregnated with some antiseptic substance. He has accordingly induced the manager of the Holkar and Sindhia-Nimack State Railways to put a few of my sleepers into the line as an experiment. Before delivering these sleepers, which consisted entirely of sapwood, he had them steeped for some days in an infusion of Behera (*Terminalia bellerica*) leaves. They have now been in the line for the whole of one rainy and one cold season, and are still as good as on the day they were placed there. My own opinion is, that the Behera leaves have done me no good, just as they have done me no harm; but the effect of the steeping has probably been to dissolve and remove from my fibres all the fermentable substances which would otherwise have produced a fungoid growth and thus induced dry rot. This is, however, my own diagnosis, and it is for you, doctors, to explain the effect of that experimental treatment on me—the patient. I have heard that Mr. Carey intends next to try sulphate of copper by Boucheries' process. I shall ask him, through my present obliging scribe, to try chloride of zinc instead, which, I have been told, has been found in Germany to be quite as effective as that expensive substance—creosote. Of course I need not tell you that white ants are quite impotent against sleepers laid in a line that is continually run over.

You will now permit me to say a few words on my value as a fuel. Perhaps it is not generally known, at least to you, Foresters, that I burn more slowly and with greater difficulty than most other woods. This is due to my being impregnated through every pore and fibre with a substance, half-gum, half-resin, the presence of which is readily detected by the characteristic smell of my smoke, and which is the main cause why I take such an unusually long time to season. This slowness and difficulty of combustion detracts from my value in the eyes of the Indian cook with his open-air fireplace, although, when split into thin pieces, I burn almost like a torch. While the gum-resin is burning and, so to say, distilling away, little heat is given off, most of it being absorbed to carbonise the wood; but by the time all the resin has disappeared, the wood, very little of which has in the meanwhile burnt into ashes, has become a mass of live coal, emitting a fierce heat.

You thus see how easy it is to convert me into charcoal. The charcoal burners of Nimar in the Central Provinces hence prefer me to every other wood. The firing of my largest kilns is easily conducted. Add to this that I am easily felled and cut up, easily carried to the kiln (being much lighter than the *Acacia Catechu* and *Anogeissus latifolia*, the charcoal of which species the blacksmith prefers) and easily piled up.

The charcoal made from my wood in Nimar is used in the State Railway Workshops at Khandwa. I have such a bad

name, however, that if once it reached the ears of the Workshop authorities that what they were using was Salai charcoal, I do believe they would at once countermand further supplies. I do not claim equality for my charcoal for the purposes of the smithy with that yielded by Teak or the *Hardwickia binata*, or the two species named in the preceding paragraph; but it cannot be so bad after all, when it has given satisfaction in a large Railway Workshop for so many years.

Then, again, I am largely employed by the lime-burners in the same district of the Central Provinces, not only in the form of charcoal, but also in the shape of billets of wood. What advantage there is in not using charcoal alone, I leave you, doctors, to ascertain, although I may say that my own idea is, that without wood added, the charcoal put in would not last enough to expel all the carbonic acid of the limestone.

With regard to the suitability of my wood for the generation of steam, there are no direct experiments to prove it. But mixed in due proportions with the hard, heavy woods, I have no doubt but that it will answer well. I have often found my way surreptitiously into the firebox of a locomotive along with the *Acacia Catechu* and *Anogeissus latifolia* without, however, diminishing the speed of the train or otherwise producing any disturbing effect on the equanimity of the driver. Truly is ignorance bliss when 'tis folly to be wise! There are not many in either the Stores or Locomotive Departments of the State Railways, who can recognise me, when once my tell-tale bark has fallen off. Theoretically considered, why should my wood not suit the engine-driver? It is a long time before it is consumed to ashes; it naturally forms large masses of live coal on the grate, when it gives out a powerful heat; and, lastly, it has in the engine all the draught it requires.

Dr. Brandis says my charcoal "is used for iron-smelting in Nimar." He must have obtained this information from an untrustworthy source, for the iron-smelters (I feel ashamed to own it) won't touch me. Their favorites are *Acacia Catechu*, *Anogeissus latifolia*, *Hardwickia binata*, and *Soymida febrifuga*.

Hitherto I have confined myself to the economic uses of my wood. I will say nothing regarding the medicinal and religious uses of the gum-resin I yield, which is as often translucent or nearly opaque as transparent.

I will now pass to a brief summary of my general utility as a forest tree.

In the first place, on the dry, rocky hills, where I form almost a pure, quasi-high forest, nothing else will come up until I have split the rock with my roots and formed some soil to enable other species to establish themselves under my open crown. My roots wander for nourishment far and wide,

throwing up numerous suckers, which in their turn become parent trees, and thus I soon cover the bleakest and barrenest hill sides with arboreal growth. You, Foresters, can aid me in doing this by digging up the ground round me here and there, a few inches deep, say 1 foot square, with a few strokes of the pick. If in this operation you wound my roots, all the better. My bark is extremely vivacious; where it is wounded, it readily develops adventitious buds. Cut a ring of bark off 3" or 4" broad, round my trunk, and you will soon see a complete crown of shoots grow on the circular wound, while my real crown overhead will seem none the worse for the phenomenon.

Then, again, I seed every year abundantly, and I grow from cuttings. Frost troubles me very much, but then my powerful, vivacious roots enable me to laugh at him. I love to bask in the torrid sunshine. Iron in the soil agrees with my constitution. Silicious soils I delight in, but I don't mind clay or limestone, provided the former is not too plastic, and the latter not in excess. Moisture I am not afraid of, though I object to bogs and marshes, and places that remain wet or damp throughout the year. I can do without organic matter in the soil, but when it *is* there, I do not fail to utilise it.

Tell me now, ye Foresters, where can ye find a species more generally suitable than myself for your *essence transitoire* in reboisement operations on stony arid hills, or in dry, barren, caked or ferruginous soils, whence all forest growth has disappeared? With very little assistance from you, I will soon spread over and take possession of the ground, splitting the hardest rock, breaking up the most highly caked soils, and enriching them with my precious dead leaves. Under the shelter of my lofty crowns fell frost shall not pass with withering tread, while the life-giving solar ray will enter as freely as before, only tempered and softened for the tender young lives below. If ye still have your misgivings, interrogate DAME NATURE, the Common Mother of us all, and she will point to this dense undergrowth of Teak and mixed species here, that straight, tall clump of poles worth their weight in rupees there, that (but why need I lengthen the catalogue?), and doing this she will say: "These are thy wondrous works, O Sálai, my elder daughter, and much reviled of men!"

I could say much more, dear Forester, about myself; but I have probably wearied you by this time, and the lengthening shadows warn my scribe that he must without delay hie back to his camp, where awaits him

No yearning Phyllis, tender maid,
All blushes, love and flurry,
But Rustam Khan, the grave and staid,
Intent on rice and curry.

But you will, perhaps, ask me, dear Forester, how it comes that I, who have never been to school, have sent you this letter.

I will therefore satisfy your curiosity. It is needless to say that I have not enjoyed even the advantage of supplying the school-master with his rod, no—not once. Nay the English language itself is only a very recent acquisition of mine, for which I am indebted to my noble and illustrious friend, the Teak, who, having travelled over every quarter of the globe, speaks all the languages of men like a native, *Mais revenons à nos moutons*.

It was a hot, sultry day. The sun had already some two hours passed the middle point of the celestial arc. It was the season when all sensible trees rest from the labours of the revolving year, in order the better to recruit their energies for the next uprising of the world of vegetable life. No breeze stirred our leafless branches; the birds forgot to chirp and carol; an odour of jungle fires hung on the breathless air, telling of death or despairing misery to thousands of our kind.

Hot and thirsty, the perspiration streaming down his bronzed rugged face, an Indian Forester, who had protected me and my companions from our raging enemy these seven long years (may flowers perpetually bloom under his feet!), came amongst us. He was our constant visitor. Not a tree or shrub or herb grew in the forest, but he sought to know and understand it. In his intercourse with us, he did not fence himself round with pedantic forms beyond which we durst not go in approaching him. He tried to mete out justice to us all. He was not always successful; but, poor man, he only did his best, and we overlooked and at once forgot his failures. I have heard it said that even in studying and dealing with your own species, you men very often make mistakes. But perhaps you think I am partial. However that is neither here nor there.

Shade there was none. He came and rested himself against my trunk, 3 feet in diameter, straight and cylindrical, and 50 feet up to the first branch. For some minutes he seemed lost in contemplation. I suppose his thoughts were of me and of the way in which I have been neglected and misjudged by those who ought to know me better, for all of a sudden, raising his head,

“Thou ill-starr’d tree,” cried the forest wight,
 „ Though all the world despise thee,
 One pen at least thy wrongs shall right,
 One faithful *fagot* prize thee.”

He spoke this and much more; but to cut a long story short I asked him to write to you, dictating word for word what you have been reading. In publishing the same, you will earn the eternal gratitude of

THE POOR SALAI.

[NOTE.—Is “THE POOR SALAI” a different species from that described by Dr. Brandis under *Boswellia thurifera*? I would answer this question in the negative. The specimens of wood examined by our learned Inspector-General were no doubt imperfect. Indeed it is obvious that his observations were

confined to tracts where the Sálai simply grows without flourishing, for he describes its crown as "*spreading*" and "*flat*," which is a characteristic of only the stunted tree. Well grown Sálai possesses an ellipsoidal crown, which becomes tabular, like the crown of most other trees, only at complete maturity. Only old trees contain heartwood, as explained by the authoress of the preceding letter. The general ignorance on this subject is evidently due to the supreme contempt with which this tree is treated, few taking the trouble to study it. The table at Punasa has "*stumped*" many a veteran Forester, no one, who had not seen that piece of furniture before, having been able to identify the wood of which it is made. The Punasa Sálai is quite suited for the lower masts of small coasting vessels. It is not absolutely *hard*, although more so than ordinary pine, and that word, as used by Roxburgh in the text of the Coromandel plants and quoted by Dr. Brandis, must be accepted in a vague or comparative sense, implying simply that the wood was harder than some that Roxburgh must have had in his mind's eye at the time. Probably he was thinking of the general erroneous opinion on the subject, and without fully explaining himself in order to be brief, employed the word "*hard*" without any qualification. As regards weight, the heartwood of Sálai is certainly not lighter than ordinary Teak timber. The dense, knotty, stunted, rock-grown teakwood of the dry hills in the Narbada Valley *may* be slightly heavier.—THE SCRIBE.]

Destruction of Eucalyptus at Changa Manga.

TO THE EDITOR OF THE "INDIAN FORESTER."

SIR,—The following particulars relating to the destruction of Eucalyptus at Changa Manga Plantation may be of interest to your readers.

In 1879 several large trees were blown down, and it was found that the roots had been eaten away by white ants; of these I could get no measurements. In May 1880, a tree, 59 feet high and 22 inches girth, at 3 feet from ground level, was destroyed from the same cause; and again in March 1881, in a high wind two more trees fell, which I saw and examined;—one was 25 feet high and 19 inches in girth, the other 41 feet high and 28 inches in girth. In both of these the sap root had been almost eaten away by white ants, and was quite dry, the trees being retained in position by the strength of two small lateral roots which acted simply as Guys.

J. C. McDONELL.

Flowering of the large Bamboo at Dehra Dun.

TO THE EDITOR OF THE "INDIAN FORESTER."

SIR,—An event of considerable interest is taking place at Dehra Dun this year, and that is, the almost general flowering of one of the large bamboos. Those of your readers who have ever been to Dehra will remember the magnificent clumps of bamboo which border the western side of the *maidan*—the old Goorkha Parade Ground. I have ascertained that these clumps were planted from root-stocks in 1851, and that the portion of shoot left above the ground was already then of a fair thickness; that the root-stocks were taken from a clump living in Dehra in that year, but where the original clump is now, or came from at first, is not known.

Another species, with longer and broader leaves, planted here and there in Dehra, but especially near the Bodyguard lines, is not flowering; and there are a few clumps of bamboo resembling, as far as I can judge, the former species (the *maidan* one) which are also not flowering, but these are exceptions. The great mass of bamboos throughout Dehra will next year have ceased their existence. Specimens will be sent to the Superintendent of the Botanical Gardens, Saharunpore, and to other botanists for determination.* Meanwhile, will some of your readers inform us, through your columns, whether there is a general flowering of a large bamboo in other parts of these provinces, or elsewhere?

Two of these clumps were entirely cut down last year, and one of them has sent up one or two thin straggling shoots which are also flowering. The stunted bushy growth of the other at present shows no signs of it. Again, a cutting from one of the clumps, with a portion of the root-stock attached, was planted out last year to fill up a gap; this, too, is flowering.

A. SMYTHIES.

DEHRA DUN, 2nd April 1881.

* It has since been ascertained that the species is *Bambusa arundinacea*—ED.

II. OFFICIAL PAPER.

Extract from a Report by Mr. D. C. Hutchins, Assistant Conservator of Forests, on the subject of the Fuel Plantations in the Bundgdroog Forest Division, dated the 21st October 1880.

* * * * *

As regards the situation of these plantations—although in the open country—they are more or less surrounded by grass lands, reserved, when the plantations were formed as grazing ground for the neighbouring villages. As has been frequently pointed out by forest officers, these grass lands are far in excess of ordinary requirements; and since the mortality amongst cattle during the famine they have been little utilized, and the long grass standing from four to six feet high places the plantations in continual danger from fire during the four dry months of the year.

In considering the present conditions and prospects of these plantations, it is necessary to glance briefly at their past history. There are some small patches of land in the plantations which were formerly under cultivation, but nine-tenths of their area was waste land covered formerly with a pernicious thorny scrub and with grass, grazed, or burnt over, yearly. The first enclosures were made in 1868, and from then till 1872 efforts were directed towards improving the indigenous growth. Seed of indigenous species was sown broad-cast, in bands, in worked patches, in shallow pits, in deep pits, in trenches, and (in places where a plough could be worked) in ploughed land. The general result under different hands and different places were concordant, *i.e.*, that if the early rains were favourable, a portion of the seed germinated, and an insignificant percentage survived the first dry season. Where the early showers, which are always precarious, were not favourable, the seed was in great part eaten by rats, and what germinated during the heavy latter rains withered like grass on the approach of the hot weather. All that remains of these sowings now is some straggling thorny acacias. Nursery plants of indigenous species gave slightly better results, but it was necessary to water them during the first dry season, and to water on a large scale is out of the question.

In 1872 the big pit system was introduced, and about the same time the casuarina tree: from this year dates all that is

valuable in the present plantations. The big pit was found to render planting in this climate a tolerably certain operation. Watering was paid for at first, but it was gradually perceived that a tree in the loose soil of a three-foot cube pit put out during the early rains made sufficient *deep* root-growth during the first monsoon to enable it to go through the ensuing dry season without watering. I have ascertained by experimental digging that the roots of a casuarina, after the first hot weather, have passed through the bottom of the pit, and were at a depth greater than four or five feet from the surface. Casuarina is an evergreen, and grows slowly all through the hot weather; its roots tapping the sub-soil moisture; its branches, bathed in the dry air of that season, must be exhaling enormously. At the end of the dry season when this strain is removed, and often before there has been sufficient rain to appreciably wet the soil, there is a visible and rapid accession of growth above ground. A watered tree, on the contrary, has no forced deep root development, and suffers when its artificial supply of water is withheld. During the droughts of 1876 and 1877 the casuarina trees planted near tanks at Bangalore died to a considerable extent when the tanks dried up. The deeply rooted trees in the plantations suffered no loss. I take this to be the physiological explanation of the value of large pits. They are very expensive even at the low rate at which the work is done on the plantations; but their value is incontestable, and has been established by years of observation. As a set-off in planting on this system no weeding is necessary.

Since 1872 planting has been followed steadily, no alteration having been made in the size of the pits. Casuarina was at first one out of a number of species—“*Eugenia Jambolana*” (Kanarese, Néralé), “*Terminalia Arjuna*” (Kanarese, Maddi or Tormatti), “*Mangifera indica*” (Kanarese, Mavu), “*Tamarindus indica*” (Kanarese, Hunasè), “*Albizia odoratissima*” (Kanarese, Bilivara), “*Acacia leucophloea*” (Kanarese, Bili Jali), “*Acacia arabica*” (Kanarese, Gobli or Karri Jáli), “*Acacia Suma*” (Kanarese, Mugli), “*Bauhinia variegata*” (Kanarese, Kanchivala), “*Albizia Lebbek*” (Kanarese, Bage), “*Vitex altissima*” (Kanarese, Nauladdi), and other hardy indigenous kinds, besides a great variety of exotics which need not be detailed in a brief report. The former with a wood inferior to, or of no greater value than, casuarina have a growth averaging about a fourth that of casuarina; the latter are most of them less hardy than casuarina and all of slower growth under the conditions of soil and climate. Casuarina has in fact year by year and under different forest officers gradually replaced all other species. It is an easy tree to rear and plant; nothing could surpass its growth on a good soil, such as, for instance, the deep red loams north and east of

Bangalore; it begins at once to deposit its needles, to kill the grass and ground herbage, and to form a forest soil; its wood is one of the best firewoods known; it has been used for building in Bangalore side by side with Burma teak. At the same time it has always been felt that something more was required. Where the loams run into gravel, casuarina looks stunted and starved; where the underlying gneiss comes near the surface and cuts down the sub-soil moisture, casuarina withers and dies during the first months of the dry season. The indigenous species obviously indicated here is sandal—a hardy tree growing anywhere, provided it is protected from fire, but one not easy to plant. A casuarina plantation in proper order has nothing to fear from fire; and the introduction of tile-pot nurseries has rendered it nearly as easy to plant sandal as casuarina. At the present moment, therefore, sandal has taken the place of other indigenous species in the plantations, and I expect to plant out about half a lakh of it there next season.

The present condition of the plantations, as regards the growth of casuarina on a good soil, leaves nothing to be desired; that planted eight years ago at only 193 to the acre (= five yards apart) has already closed overhead and is safe from fire. On less favourable soils there have been failures; the growth has not been so good, and no early prospect of better forest conditions is apparent. Casuarina as a species is intolerant of shade, and young casuarina put in quincunx does not grow well under older trees, although trees of the same age planted close grow up as regular and as dense as a young fir plantation similarly placed. Sandal, on the other hand, rejoices in partial shade, and it appears not to object to that of casuarina. I have observed sandal in a garden in Bangalore growing well under casuarina. In the Kurandhalli plantation during the past season some of the quincunx pits between old casuarina were planted with sandal. Sparse planted casuarina, if permissible at all, as in the case of its being found to associate well, on a large scale, with sandal, should be cut off by belts of dense planting from the fires of the adjoining grass lands and also intersected by belts of dense planting. No case of incendiary fires has occurred on the plantations, and they are closed annually during the fire season against all comers. The planting done during the past season is all dense—at the rate of 538 to the acre. Dense planting, if well performed, never permits the growth of much grass. The pitting is three yards apart or two yards from the edge of one pit to the edge of its neighbour. In this two yards most of the grass is killed by the earth thrown over it from the pit; so that when the pits are filled in and transplanted, the young casuarina starts from the first year with nearly clean soil. Sparse grass has grown up around it by the end of the second year. By the end of

the third, there is a considerable shade over the grass, and the trees close in, from five to six years, depending on the soil.

The measures which have been adopted since the fires of the last hot weather are—

1st.—A belt 22 yards broad of dense planting or pitting round the entire boundary of the plantation just within the aloe hedge.

2nd.—A narrow belt ten yards wide of similarly dense pitting on the outside of the aloe hedge. These pits will next season be filled with "*Acacia concinna*" (Kanarese, Sigè) plants which will be roughly lopped from time to time and trained as a hedge and barrier impenetrable alike to fire and all trespassers. Grass, it has been observed, does not grow under the Sigè bushes outside villages. There is no reasonable doubt that the value of the soap-nut will amply reimburse the cost of this hedge.

3rd.—Till the measures can take effect, the outside grass will be burnt off as early as possible in the season; blocks with grown-up trees will be let out for grazing (where the planting has been regular), and extra watchers entertained during the fire season.

Attempts have been made unsuccessfully to get the neighbouring villagers to cultivate the contiguous grass lands on easy terms as low as one-half the usual Kandayem having been offered; but as I have mentioned before, they have already as much land as they can cultivate, and scrub land cannot easily be brought under cultivation.

I append a statement showing the cost of the plantations, the year of their formation, and the approximate area planted up to date; also a note of rates current and a tabular statement of a cubage taken by me in February 1879 through a portion of the Benganur plantation. The portion to which the cubage refers had fully closed, and was selected as an example of the most advanced planting.

* * * * *

FUEL PLANTATIONS IN THE NUNDYDROOG FOREST DIVISION 341

*Statement showing the cost of the plantations, the year of their formation, and the approximate area planted up to date—
September 1880.*

Name of Plantation.	The year of formation.	Cost up to date.	Area planted up to date.	Cost per acre.	REMARKS.
		Rs. As. P.	Acres.	Rs.	
Doda and Chicka Hosa Haradi.	1871-72	23,869 1 9	637½	37	The cost of tools and seed, i.e., Rs. 22,976-10-4, being shared by the smaller plantations in the forests, has not been entered here.
Nelal ...	1871-72	17,117 10 2	471½	36	
Kadgodri ...	1871-72	17,283 5 6	455½	38	
Appasandra ...	1871-72	12,355 10 4	376	33	
Marsandra ...	1871-72	14,102 1 2	514	27	
Jadiganhalli ...	1866-67	16,202 15 10	291	55	
Kurandhalli ...	1871-72	12,438 8 6	460	27	
Karpanhalli ...	1871-72	7,716 15 9	168	46	
Benganur ...	1871-72	782 2 7	8	97	
Bani Chendrapur	1879	1,072 14 10	16	67	
Tatnur ...	1879	530 11 6	.....	...
TOTAL ...	...	1,23,472 1 11	3,387½	36	

Rates current for planting in 1880-81 in the Nundydroog Division.

		Per rupee.	Per 1,000 trees.
		Quantity.	Rs. As. P.
Yard cube pits average at ...	...	25	40 0 0
Filling ditto ditto ...	...	250	4 0 0
Total pits ...	...	.....	44 0 0
Setting tile pots ...	...	1,000	1 0 0
Watering and weeding for six months ...	...	1,000	1 0 0
Total nursery charges ...	...	.....	2 0 0
Transplanting for distances within a mile, including watering, if necessary, till plant is established ...	...	400	2 8 0
Adding these three charges, for pits, nursery plants and transplanting, the cost of planting for work is	...	.....	48 8 0
To this must be added cost of tile-pots, tools and ditching, assuming a tile-pot to last an average of six years ...	...	.....	2 0 0
Also the cost of the local plantation establishment which is 12 per cent. of the work, i. e.	6 0 0

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	Per rupee.	Per 1,000 trees.
	Quantity.	Rs. As. P.
There are no subsequent charges for weeding or maintenance
Therefore the total cost of planting per 1,000 trees, exclusive of supervising establishment, is	56 8 0

Or planting at three yards apart and allowing seven per cent. for failures, Rs. 28.8 per acre.

The cost of planting by the use of tile-pot nursery has been reduced Rs. 15 per 1,000 plants.

Without pits the cost of planting as above is Rs. 5.8 per acre. Where scrub has to be cleared, it costs from Rs. 1 to 3 per acre, so that in all cases the cost of planting may be taken as within Rs. 30 per acre with pits, and Rs. 8.8 without pits.

Tabular Statement of a cubage taken through a portion of the Bengamr Plantation in February 1879.

Girth at 6 feet from ground in inches.	Quarter girth squared in feet.	Average height in feet.	Average cubic contents in feet.	No. of trees.	Cubic contents, total for each class.	Distance apart.	Age.	Area over which cubage was taken.	Total yield per acre.	Total yield per acre per year.	REMARKS.
6	016	23	368	35	1288	Originally planted at 10 feet apart, at present 378 to acre, which is a little less than 11 feet apart. Trees have closed overhead and nearly killed all ground herbage.	Years.	Acres.	C. ft.	C. ft.	Vacancies and trees "dominés" falling within the cubage= 79.
8	027	29	783	53	450						
10	043	31	1333	65	8664						
12	063	35	2205	84	18522						
14	085	36	3060	92	28152						
16	111	38	4218	82	34588						
18	140	42	5880	53	31164						
20	174	42	7380	32	23386						
22	210	48	10080	12	12096						
24	250	50	12500	3	3750						
27	317	50	15850	1	1585						
TOTAL	512	163645						

The fraction required to reduce the mean girth from the girth at five feet is not known, and at this stage it is not worth while sacrificing trees for its determination. Roughly, and for the present calculation, it is assumed that the cubic content of the branch pieces covers the difference between the two girths. This is well within the mark, judging from the appearance of the trees and what was taken off lately in clean pruning the trunks up to six feet. It must further be remembered that the rule—the square of the mean quarter girth multiplied by $\frac{1}{4}$ the height—gives a volume which is $\frac{2}{3}$ ths the true volume, while in a fuel plantation the true volume is the one which should be taken.

]]]. REVIEWS.

"The Journal of Forestry and Estates Management."

It is much regretted that our last number (January) should have appeared without the usual review of the last three numbers of our English contemporary. We must now, therefore, deal with the six numbers, from October 1880 to March 1881.

The *October* number opens with an illustrated article on Steam Cultivation, which has at present no interest for Indian readers.

We have the next paper on "Dragging timber by Steam." At present we have indeed a natural machine in the elephant, whose great sagacity in the matter of moving large teak logs has often been the wonder of visitors to the forests of British Burma; but it will be long before we can replace nature with the more regulated precision of machinery.

Mr. NEIL has a paper with the somewhat surprising title of "Hints towards a Science of Forestry." It is instructive to read this, and to learn that "things seen are facts," but that "the causes, principles and reasons of things are science." But we were hardly prepared to hear that scientific forestry is only a possibility, and to be a "reality of the future." Then the writer goes on neatly enough to tell us that forest science must take account of everything about a tree, the creatures that attack it, the soil under its stem, and the air around its heart; but the writer seems to be wholly unaware that this is perfectly well recognized, and that the most splendid literature dealing with all branches of the subject exists, not indeed in English as yet, but in the languages of the Continent.

There are many short papers of interest in this number though not directly useful for India. At page 409, however, will be found a sketch with a description of a mechanical "tree-feller." This really seems to be promising and worthy of attention. It is manufactured by Messrs. S. Worssam & Co., of Chelsea, London. Nothing is said of the cost.

NOVEMBER.—Among the Editorial Notes will be found an extract from the "Agricultural Returns." This annual blue-book generally contains matter of much importance and interest. This year it contains a return of the acreage of woods, and plantations. Since 1872, the acreage under wood in Great Britain has increased from 2,187,000 acres to 2,409,000.

A series of papers on "Appliances used in Forestry" is commenced in this number.

Mr. BURROWS also commences a series of descriptive notices of different varieties of trees, all known by the common generic name. In this number, under the head of "The Oak," there are a few notes on all the chief varieties of oak. If these were only accompanied by a brief botanical description, carefully selecting certain salient features for enabling people who are not professed botanists, to identify the species and varieties, and by some notice of the qualities, color, strength, &c., of the wood, they would form a very valuable collection.

Much space is naturally occupied in this number by the report of the Annual General Meeting of the Scottish Arboricultural Society. At page 443 will be found the list of competition essays, among which we are glad to observe that Mr. Ferguson, Deputy Conservator in the Madras Presidency, has gained a gold medal.

Some of the essays will probably be of considerable interest to Indian readers, among them may be mentioned :—

The Comparative Value of Timber as affected by altitude of selection. (*T. Wilkie*).

The rearing and management of hard wood plantations (*David Iait*).

On various modes of enclosing plantations (*A. Slater*).

DECEMBER.—More from the Agricultural Returns of Great Britain: an extract from the interesting note on this subject we give in another place.

Indian foresters who are cultivating the Edible or Spanish Chestnut should read Mr. Burrows' paper on this valuable tree.

Under the head of "Foreign Exchanges" notice is taken of the changes in the staff at the Nancy School. But the new director is M. A. PUTON, not *Putard*. This, however, has been corrected in the following number. We should have thought also that the names of PARADE and LORENTZ were sufficiently well known to save them from being made into one man under the name of Lorenz Parade!

JANUARY.—Those who are interested in the report of the Commissioners of Her Majesty's Woods and Forests will find a review of the report for 1880 at page 551, *et seq.*

The Editor in this number is angry with us for our defence of the system of supplying trained officers. We are quite content to let our remarks speak for themselves. Any one who will take the trouble to read them will judge whether there is more in our articles than the occasion justified. We have merely contended that, if there is no foundation whatever for the persistent abuse which the English Journal has, without any attempt at proof, heaped on a system, which in the experience of every Conservator in India has produced excellent Forest Officers.

This abuse was repeated, till it was feared that possibly some effect might be produced in misleading people at home. We

therefore reluctantly entered into the subject and exposed the real object of this attack on the present system. There is not a word in all our article that has ever tended to depreciate—far less to insult—any class of men. On the contrary we were most careful to show how fully we recognized the value, in their own sphere, of the class which the Editor now, with gross unfairness, charges us with insulting. But it is silly to pretend that there are not differences in education and social position which very greatly affect a man's usefulness in one sphere or another of official life.

FEBRUARY.—In this number is an account of Sir R. Temple's lecture on Indian Forests, before the Society of Arts. Though rather *couleur de rose*, the lecture is, on the whole, reliable, and stands in rather strange contrast to the Editor's repeated assertions that the Indian Forest Administration is "rotten," "ruinous," and so forth. But Sir R. Temple is opposed by the experience of every Forester in India, when he says that forestry can be learnt without the aid of large areas of natural forest. The idea of a great estate demarcated and managed on certain principles must be thoroughly assimilated, and how is that possible without forests? How is a man, who has been taught to deal with trees as individuals in a neat plantation of a few acres, to know what to do with a great area of natural pine forest, or a great "sál" jungle? Sir R. Temple acknowledges that the Nancy teaching has turned out a very valuable set of men. This conclusion, which is hopelessly at variance with what the English Journal has so often asserted, is due solely to the fact that the teaching inculcates the *idea* of "forest estates," and familiarises the student with a regular plan of working, an *aménagement*, as it is called in France, which deals with the estate as a whole, and looks towards a given object, whether to maintain a fully stocked and properly constituted estate, or to restore an ill-treated one, or to "convert" a forest of a low class into one of a superior class.

Foresters here will read with interest Mr. McCorquodale's paper as to the question whether forests are injured by leaving branches and debris of cuttings to decay in the forest.

Mr. BURROWS has a continuation of his series of papers on trees. The tree he describes as the "Ash."

A paper on disease of the larch by Mr. McLAREN should be read. All efforts to introduce larch even in the temperate hill climates of Northern India have hitherto failed, but the study of disease in trees, even those which do not grow here, is always instructive.

A paper on a proposed forest school at Epping Forest should be read. It would probably succeed well for English Foresters; it certainly will not answer for India.

MARCH.—Mr. BURROWS has a paper on the valuation and measurement of timber, which well illustrates the absolute and

total difference there is between forestry as understood in the parks and plantations of England, and in Indian or other large estates managed as natural forest. There is a rather useful "Memoria Technica" given at page 690, the object of which is, when measuring tables are not at hand, to enable the Forester to know the cubic contents: thus, if the quarter girth is six inches, the contents in cubic feet will be represented by one-fourth of the entire length in feet;* if $8\frac{1}{2}$ inches, by half the length; if seventeen inches, by twice the number of feet in the entire length. These proportions given for the most useful sizes can be committed to memory.

Mr. ROBERT BAXTER commences in this number a paper on "Underwood," but this is entirely, (so far) from the English plantation point of view.

Mr. MICHIE'S paper on "Pruning Forest Trees" should be read. But with regard to pruning conifers it will be found in this country that it is far better, as a general rule, to let them alone, and it is more than questionable whether in dealing with deodar and other pines, close grown as they must be in Himalayan forests, it is not better to leave the small side branches, which die of themselves, to fall off. It is not our experience that they give rise to knots in the timber as the stem grows. The paper, however, should be studied, and some useful hints cannot fail to be collected.

In the "Editor's Box" will be found a letter on a plan for a Forest School at Epping Forest. This is sensible, and such a school, no doubt, would find ample scope in the training of English and Scotch Foresters for the conditions of their own work, without interfering in the training, so different in every respect, required for the large forest estates of India.

To conclude: Here is a "cutting" about the Upas tree. The tree is found in the Tenasserim Circle of British Burma. What could have given rise to the fable? :—

"THE UPAS TREE.—Prominent among the plants recently received at the Melbourne Botanical Gardens, from Dr. Schomburgk, Director of the Adelaide Botanic Gardens, is the *Antiaris toxicaria*, the celebrated Upas tree of Java. The fabulous poisonous properties of the Upas tree were first circulated by a Dutch Surgeon named Foersch, who, according to Dr. Masters, stated 'that the tree grew in a desert tract, with no other plant near it for the distance of ten or twelve miles. Criminals condemned to die were offered the chance of life if they would go to the Upas tree and collect some of the poison. They were furnished with proper directions, and armed with due precaution, but not more than two out of every twenty ever returned. Foersch states that he had derived his information

* For example :—Quarter girth, 6 inches; length, 12 feet; cubic contents = 3 cubic feet ($12 \div 4$). This result can be tested by the usual formula $\frac{g^2}{12} \times l = 3$ cubic feet.

from some of those who had been lucky enough to escape, albeit the ground around was strewn with the bones of their predecessors; and such was the virulence of the poison that there are no fish in the waters, nor has any rat or mouse, or any other vermin, been seen there, and when any birds fly so near this tree that the effluvia reaches them, they fall a sacrifice to the effects of the poison. Out of a population of 1,600 persons who were compelled, on account of civil dissensions, to reside within twelve or fourteen miles of this tree, not more than 300 remained in less than two months.' ”

The Annual Report of the Forest Board of South Australia for 1879-80.

IN our number for July 1880 we reviewed the South Australian Forest Report for 1878-79. We have now received that for 1879-80, which is considerably less voluminous, though perhaps more to the point, than its predecessor. It shows, however, a considerable advance in forest matters during the year. As before, the chief work is Plantation, and to this everything seems to be subordinated, for, as we noticed in the case of 1878-79, the reserved forests appear to be principally used as grazing grounds. The action of the Government of the Colony hitherto in this respect seems difficult to understand, for while there is abundant evidence in the Report to show that it is fully alive to the impossibility of proper regeneration, while the areas to be regenerated are regularly grazed over, it does not ever seem to have occurred to it till lately that the excessive grazing might be stopped, or at any rate only allowed in those forests where it could do little harm. In para. 238 it is said: “All over this area, (the Wirrabara Reserve) there are indications of thousands of seedlings having come up every year, but these have been eaten down so much by stock that they will never attain to anything like useful trees. In several places, however, where the seed has fallen on congenial soil, and where the seedlings have come up so thickly as to escape the ravages of herbivorous animals, many fine saplings of all sizes are to be met with.” But we are glad to see from para. 242 that “the Board are now agreed that it would be desirable in many cases to fence in portions of the Reserves for regeneration purposes, as more profit would accrue to the Board eventually from the timber than from the rent for pasturage.” This shows that, although they cannot reconcile themselves to losing the whole of the revenue from grazing, yet they find regeneration and grazing so incompatible that they are willing to forego a portion of the profits for the sake of some reproduction.

About 4,500 acres were added to the Reserves during the year, so that the total area is now 239,368 acres, or about 374 square

miles, the largest Reserves being those of Bundaleer, Wirrabara, Woollundunga, Tickera, and Mount Burr. In most of the Reserves the system of leasing the land for pasturage, occasionally resuming portions to be fenced and allowed to reproduce, and assisting this natural reproduction by systematic plantation, appears to be in force. Fire protection seems not to be neglected, and is, in South Australia, arranged for by ploughing broad "fire-breaks" round and through the plantations in different directions. But these "fire-breaks" seem not to have been much tried, for the year was, it would appear, a favourable one for fire protection.

Regarding the plantations there is not much to note, except that 906 acres were planted, making a total area of 1,840 acres of plantations. These plantations are naturally chiefly of wattles and eucalyptus and other indigenous trees, though attempts are being made to acclimatize a very large number of exotic trees, among which we see mentioned teak, sissu, khair, kikar, siris and other Indian trees. The results of the experiments with these trees are not recorded, and it is not quite understood how it is expected that they will grow well in the same country where the English oak, larch, spruce, fir and walnut are doing well, unless it is that the latter are at some elevation above the sea. But we do not find this stated or explained.

The financial results of the year's work were as follows:—

<i>Revenue.</i>		<i>Expenditure.</i>	
	£		£
Rents and Pasturage ...	5,485	Salaries and Wages ...	4,225
Timber ...	540	Fees to Members of the Board ...	31
Sundries ...	45	Sundries ...	1,089
Total ...	6,050	Total ...	5,395

giving a surplus of £755.

We are glad to see that the extension of Reserves is not neglected, as it is proposed to take up the "Black Rock" Reserve of 18,000 acres, the chief tree in which is the pine (*Frenela robusta*.) The forest is now, Mr. Brown the Conservator states, being largely cut and damaged, but he proposes by fencing and regenerating parts of it gradually in rotation, to arrange for reproduction and for the formation of a valuable and extensive pinery.

Forest Report of the North-Western Provinces and Oudh for 1879-80.

THERE is not much to be noticed in the three reports which combine to make a large volume, nor in the orders of Government circulating them. Fire protection seems to have extended, as pointed out by the Government of India, to 20 per cent. of the total area. There is some discussion in the reports of the Central and Oudh circles, on the comparative results in revenue and expenditure of the North-Western Provinces, compared with other provinces, and as the comparative results of fire protection. But such a comparison can scarcely fairly be made, as the review points out, without great consideration of local details. In regard to the area of Reserves, it would have, for instance, to be considered that in the Central Provinces a considerable proportion of the "Reserves" are second class Reserves, in which systematic fire protection is not attempted; that in Bengal and Assam the large areas in the Sundarbans, Cachar, and Chittagong do not suffer much from fires; and that, consequently, special works and expenditure are not needed. If some central authority could compile a table—and this may possibly be done in the Inspector-General's review, which is not yet out, giving the results of the different provinces with due regard to local differences of conditions—it would be an interesting comparison; but the tables given by the Oudh and Central circles reports have little or no statistical value as they stand. Then too must come in the question of inflammable material. The Oudh report speaks of the forests there having more inflammable material than those of the Central Provinces, which may well be the case, but even within a single province, the difference between different areas in respect of inflammability is very great. We know, for instance, of large areas in which much of the forest is filled up with long grass, often ten to fifteen or even more feet high, while in others in the same province there is nothing much worse than dead leaves. So that really comparisons are impossible, and they may also be called objectionable as tending to incorrect estimations of work done.

The financial results of the three circles were:—

Receipts	...	...	...	Rs. 10,39,986
Expenditure	...	...	...	" 7,16,594
				Surplus
				Rs. 3,23,372

the surplus being contributed about equally by all three circles.

Select Extra-tropical Plants readily eligible for Industrial Culture or Naturalization.

BY BARON FERD. VON MÜLLER, K.C.M.G., &c.

THIS is an Indian edition of an Australian work which was some years ago widely circulated in India, and has, it seems, been specially printed by the Government of India for circulation. As an index of information regarding economic plants, it is likely to prove very useful, though we are convinced that if the writer intended his work chiefly for Indian enquirers, it would have been better if he had visited India first. We have not had time to examine the book very closely, but here and there a few indications occur which shew that a greater acquaintance with Indian botany would have benefited the book, and made it really more useful. In the genus *Acer* we note that, while some space is devoted to the European and American maples, those of India are dismissed with a short note on *Acer niveum*, a Burmese species, and a remark that several others worthy of cultivation occur on the mountains of India. Surely the common north-western species, *A. pictum* and *A. cerasium*, and the beautiful north-eastern species *A. Campbellii*, probably the largest of the genus, deserved mention before the comparatively rare *A. niveum*. Some similar remarks might be made on the treatment of the Indian oaks. We note that the author still persists in the old story that *Æsculus Hippocastanum*, the horse-chestnut of European gardens, is a native of the Himalaya. There are only two species as yet known in India—one is the common tree of the North-West Himalaya, *Æ. indica*, and the other the beautiful *Æ. punduana* of the swamp forests of Northern Bengal and Assam; while *Æ. Hippocastanum*, as may be seen at page 104 of the "Forest Flora," has never yet had its original home definitely settled.

In speaking of *Arundinacea falcata*, Baron von Müller talks of the stems "attaining a diameter of only four inches": we doubt if it ever, in the most exceptional cases, reaches one inch, while most of the stems we have seen must have had a diameter of even less than half an inch. As for its reaching forty feet in height, we doubt if it ever goes much beyond ten. Talking of bamboos, we were rather amused to read under *Bambusa arundinacea* that its seeds are useful for feeding fowls. The fowls would have a bad time of it if they depended much on bamboo seed for food, for the general flowering occurs, as far as is known, only at intervals of about thirty years. The whole information regarding bamboos is rather misleading, for instance *B. vulgaris* is spoken of as "the large unarmed bamboo of Bengal," the fact being that *B. vulgaris* is not an Indian species at all, and is only occasionally found in cultivation.

And how is it then that he has omitted it from the list at page 302? Turning from the bamboos to the canes, we find the latter represented only by *C. montanus* of Sikkim, a species which is now extremely rare and difficult to procure. No notice is taken of the other good Himalayan kinds, of the common *C. Rotang* or the fine *C. latifolius* of Burma.

If any of our readers are acquainted with the system of manufacture of Tea as carried on in India, they will derive considerable amusement from the perusal of the description at page 54 of *Camellia Thea*. We will not discuss the statements therein gravely printed, except to say that the author has yet to learn the meaning of such terms as "Pekoe" and "Souchong," and to draw notice to the "Tea-preparing machine." This must be a wonderful invention if it can do all that seems suggested by the writer; if he can put the green leaf in at one end, and turn out tea at the other, his machine ought to be a fine speculation!

In the article on Sissu, Panjab foresters may be interested to hear that according to the statement of a Madras forest officer "in the Panjab artificial rearing of Sissu is remunerative at only fifteen inches annual rainfall with great heat in summer and sharp frosts in winter." Baron von Müller seems to have made a great discovery when he says that our well-known "Amaltas" tree, the common *Cassia Fistula*, has been "traced by Sir Jos. Hooker to the dry slopes of the Central Himalaya."

Curiously enough, the cocoanut palm is omitted, while a place is found for *Borassus* and *Arenga*; and while describing a large number of temperate fine flowering shrubs, no notice at all is taken of the Rhododendrons. These are, however, matters concerning plants of which in India we know something more, and we have no doubt that, as far as regards Australian and other plants, our readers will find the book, as we have, a good book of reference, though it can never hope to compete with such really good works as the "Treasury of Botany."

IV. NOTES, QUERIES AND EXTRACTS.

INDIAN TURPENTINES.—It is only recently that some of these have been chemically investigated; and it is now interesting to learn that the crude turpentine of *Pinus khasyana* from Burmah has been examined, with the result so far that the liquid or "oil of turpentine" obtained from it, is remarkably pure and free from smell.

It has apparently an unusually great amount of action on polarized light, the rotatory power of a 200mm. column being about $+ 76^\circ$ for light of refrangibility of the D line, whereas that of French oil of turpentine is only 60° , and American oil 30° .

The oil from *P. longifolia* apparently has a much lower rotatory power (13°).

We understand that Sir J. Hooker has applied for larger samples for chemical examination.

Perhaps some new hydrocarbon may be discovered: who knows?

THE Kodza (*Broussonetia papyrifera*) is extensively cultivated throughout the Empire of Japan. It thrives best on dry sunny slopes, and is propagated by cuttings. About three years are allowed to elapse before gathering the first annual crop, which is done about November, by cutting off the shoots close to the ground. These are cut into short lengths and steamed in huge iron pots, so as to loosen the bark. This bark is stripped off, the outer dark-coloured rough skin is scraped off, and used for the coarser qualities, and the finer parts are washed, kneaded, and then bleached in the sun. The last is boiled in a lye, made from the ashes of buckwheat straw generally, to free it from gummy or resinous matter, and is then well pounded between stones or with mortars, some of which are worked by water in districts where such power is to be obtained. The fibres now being separated the knotty portions are removed, and the pulp resulting is steeped in pure water mixed with mucilage, obtained from the bark of *Hydrangea paniculata* and the root of *Hibiscus Manihot*.—*Paper Makers' Journal*.

It appears that the climate of Bangalore and the higher parts of the Mysore plateau is better adapted to the Carob tree than that of the Panjab. Some pods, grown in the Lál Bág gardens at Bangalore, were lately submitted to Mr. Baden-Powell, and two of these returned with the remark that "pods, equal

to these, had been grown in the Panjab," are considerably below the *average* of the Bangalore pods. Indigenous seed from these Bangalore trees has, this year, been sown in the Government plantations, and some of it has gone west to the coffee planters, so that there is every chance of the tree being thoroughly tried in Mysore. The writer's experience with plants raised from European seed is, that they are hardy in Mysore, only when on good soil and in low-lying situations. Restricted to land of this description there is ample room for the economic planting of Carob as a hedge-row plant, and the value of the pod to the half-starved cattle of the hot weather, and the totally starved cattle in times of drought, would be incalculable. How the tree will acclimatize is a subject which admits of much speculation, and one in which it is to be earnestly hoped the facts will be recorded.—K. H.

HINTS CONCERNING SAWS.—A saw just large enough to cut through a board will require less power than a saw larger, the number of teeth, speed, and thickness being equal in each. The more teeth, the more power, provided the thickness, speed, and feed are equal. There is, however, a limit, or a point where a few teeth will not answer the place of a large number. The thinner the saw, the more teeth will be required to carry an equal amount of feed to each revolution of the saw, but always at the expense of power. When bench-saws are used, and the sawing is done by a gauge, the lumber is often inclined to clatter and raise up the back of the saws when pushed hard.

The reason is that the back half of the saw, having an upward motion, has a tendency to lift and raise the piece being sawn, especially when it springs and pinches on the saw, or crowds between the saw and the gauge, while the cut at the front of the saw has the opposite tendency of holding that part of the piece down. The hook or pitch of a saw tooth should be on a line from one-quarter to one-fifth the diameter of the saw; one-quarter pitch is mostly used for hard, and a one-fifth for a softer timber. For very fine-toothed saws designed for heavy work, such as sawing shingles, &c., even from soft wood, one-quarter pitch is best.—*Mechanic*.

We see that Colonel Pearson, formerly Officiating Inspector-General of Forests in India, has been recommending to Government that Forest Officers on leave should visit the works in the French Alps, which have been undertaken with the view of reclothing denuded areas and preventing landslips. Colonel Pearson's proposals, which we reproduce, have been accepted by the Secretary of State, who states himself prepared to sanction the deputation of Forest Officers for the purpose:—

I am induced by the late disastrous landslip at Naini Tāl to do myself the honor of addressing you with a view, if possible, to the deputation from time to time of any Forest Officers who may be at home from India on furlough to visit the works in the Basses and Hautes Aples (especially near Barcelonnette and Embrun) with a view to the prevention and repair of similar givings-way of the mountain sides in the Alps. There are huge landslips in the Alps which have covered the vineyards and habitations for three to four kilometres along the bottom of the valleys, and have destroyed property to an enormous value, but which have been successfully treated by various works, and especially by planting the hills around and above them, thereby preventing the water, when there is a heavy fall of rain, from forming a torrent, which is the main cause of these catastrophes. Some of these landslips must be three or four times the size of that at Naini Tāl, and it is impossible to suppose that the same means which have been effective in the Alps should not equally succeed there.

THE gradual extinction of the forests in the United States, while no adequate provision is being made to replace them, is again attracting attention in that country. In the State of New York wood is becoming scarcer and more inaccessible every year. In many States the forests on level ground have for the most part disappeared, and only remain on high hills and mountains, where they are not easily reached. Apart from the fires which make havoc of the forests, the large consumption of wood in various industries is of itself sufficient to account for their disappearance. Some interesting information on this point is given by the United States *Monetary Times*. To make shoe-pegs enough for American use consumes annually 100,000 cords of timber; and to make lucifer-matches 300,000 cubic feet of the best pine are required every year. Lasts and boot-trees take 500,000 cords of birch, beech, and maple, and the handles of tools 500,000 more. The baking of bricks consumes 2,000,000 cords of wood, or what would cover with forest about 50,000 acres of land. Telegraph-poles already erected represent 800,000 trees, and their annual repair consumes about 300,000 more. The "ties" of the railroads consume annually thirty years' growth of 70,000 acres; and to fence all the railroads would cost 45,000,000dols., with a yearly expenditure of 15,000,000dols. for repairs. In the meantime, straw lumber has been manufactured to some extent in Kansas, and is said to answer the purpose very well. If this manufacture comes into general use, it will to a certain extent relieve the pressure on the forests.—*St. James' Budget*, February 1880.

EFFECTS OF FOREST DENUDATION IN WESTERN RUSSIA.—"In consequence of the reckless and extravagant felling of timber that has prevailed throughout Western Russia during the greater part of the present century, several of the streams feeding the Dnieper have become dried up, whilst others contribute so little water to the great river that its navigation has already suffered serious prejudice, and is in some portions of its course threatened with absolute interruption. Rocks and sandy islands in great number, forming sections of its bed, may now be seen where a few years ago from twelve to fifteen feet of water hid them from view. As the Dnieper traverses and largely contributes to the prosperity of no fewer than nine Russian provinces, or "governments," this falling-off in its dimensions and capacities is in reality little short of a national calamity, for which, however, Russian landowners and the Mir have only to thank their own ignorance and improvidence. Enormous tracts of forest abutting on the Upper Dnieper have been within the last few years completely denuded of trees, and the huge woods formerly covering the districts watered by the Lower Dnieper, now for the most part arid steppes, vanished before the axe so long ago that men of middle age scarcely remember their existence. Similarly the forest lands of the Beresina, Pripet, and Desna, three important feeders of the Dnieper, have been laid bare by their boyar and peasant proprietors to such disastrous purpose that those once broad and potent rivers have dwindled to insignificant streams. In tolerating such wholesale destruction of timber the Forest Department in the Russian Home Ministry cannot but have been grossly neglectful of the supervision and control which it is fully empowered to exercise over private as well as imperial property throughout the Czar's dominions."—*Journal of Forestry*, November 1880.

WOOD PULP AND PAPERMAKING.—Two kinds of wood pulp are used in the manufacture of printing paper, respectively designated as "mechanical pulp" and "chemical pulp." Any ordinary wood which is fibrous, free from knots and decay, and is easily disintegrated, is suitable for making chemical pulp, though the whiter the wood and the less acid it contains the better. The wood is cut into small pieces, diagonally with the grain, by revolving knives, just as logwood is cut for dyeing purposes. It is then treated with a super-heated bath of caustic alkali, then bleached, and afterwards subjected to the same processes as are clean rags. In making mechanical pulp no chemicals are used—not even lime. Any ordinary whitewood is suitable for the purpose, but poplar is preferred, although the dark heart is not used. The process of manufac-

turing is the most stupid that could have been devised, yet it is cheap. Water power is used, and it is estimated that one cord of wood, with two stones or emery wheels, and thirty-horse power, will produce the equivalent of from 1,000 to 1,200 pounds of dry pulp per day, with the labour of three men—one to attend to marking and sawing the wood, one to attend the stones, and one to look after the pulp. The wood is used soon after it is cut, or, if seasoned, it must be steamed. The sticks are pressed endwise against the stones or wheels, and with a plentiful supply of water they are literally ground to pulp, thus destroying the fibre. Unlike the chemically prepared article, this pulp is not allowed to dry before being used. The damp sheets are folded, packed in bundles, and sold, with an allowance of 40 per cent. for the moisture. To manufacture paper from it, the addition of some kind of fibre is essential—say from 20 to 80 per cent., according to the kind of paper required. Good printing paper is made from the chemical pulp without the addition of any other fibre, and the use of it is desirable in making even the best book paper. Some excellent book paper is made of 40 per cent. of this pulp, and the printing paper now being used by the government is made wholly of white spruce pulp. Machinery of the capacity for making say 7,000 pounds of rag paper per day will turn out from 12,000 to 13,000 pounds per day, if 40 to 50 per cent. of pulp is used. At the present time chemical pulp is almost as expensive as rags in manufacturing ordinary printing paper.—*Philadelphia Record*.

VJ. EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.—

No. 815F.—31st December 1880.—*Mr. T. J. Campbell*, an Assistant Surveyor of the 4th Grade in the Revenue Survey Department, is appointed to officiate as a Sub-Assistant Conservator of Forests, on probation, with effect from the 11th November 1880, the date on which he joined his appointment. *Mr. Campbell* is posted to Assam.

No. 5.—19th January 1881.—*Mr. G. Mann*, Conservator of Forests, having returned from the privilege leave granted to him in Notification No. 245, dated the 23rd September 1880, assumed charge of his duties from *Mr. W. R. Fisher* on the forenoon of the 11th January 1881.

No. 57F.—24th January 1881.—*Mr. A. Weston*, Officiating Sub-Assistant Conservator of Forests in British Burmah, is confirmed in his appointment, with effect from the 7th June 1880, and is appointed to officiate as an Assistant Conservator of Forests of the 3rd Grade from the same date.

No. 83F.—27th January 1881.—*Messrs. A. F. Broun* and *F. B. Bryant*, who have been appointed by Her Majesty's Secretary of State to the Forest Department of India, are appointed Assistant Conservators of Forests of the 3rd Grade.

Messrs. Broun and *Bryant* are attached to the North-Western Provinces and Oudh, and their appointments will have effect from the 9th January 1881.

No. 95E.—28th January 1881.—*Mr. E. E. Fernandez*, Assistant Conservator of Forests of the 1st Grade, is transferred from the Central Provinces to the North-Western Provinces and Oudh.

No. 46F.—18th January 1881.—*Mr. E. F. Litchfield*, Assistant Conservator of Forests of the 3rd Grade, attached to the Forest Survey Branch, is promoted to the 2nd Grade of Assistant Conservators, with effect from the 30th December 1880.

No. 158F.—14th February 1881.—*Mr. M. J. Slym*, officiating as a Deputy Conservator of Forests of the 1st Grade in British Burmah, will revert to his substantive appointment of Deputy Conservator of the 2nd Grade, with effect from the 8th December 1880.

No. 171F.—16th February 1881.—*Captain C. W. Losack*, at present officiating as a Deputy Conservator of Forests of the 2nd Grade in the Central Provinces, is confirmed

in that appointment, and *Messrs. W. R. J. Brereton* and *C. J. Ponsonby* are promoted from the 3rd to the 2nd Grade of Deputy Conservators in the North-Western Provinces and Oudh, with effect from the 8th October 1880.

The 15th March 1881.—*Mr. J. McKee*, Superintendent of Forests, Rewah, is granted furlough to Europe for one year, under Section 8, Supplement F, of the Civil Leave Code, with the usual subsidiary leave, from 1st April 1881, or such subsequent date as he may avail himself thereof.

No. 213F.—*25th February 1881.*—*Mr. T. A. Hauxwell*, who has been appointed by Her Majesty's Secretary of State to the Forest Department of India, is appointed an Assistant Conservator of Forests of the 3rd Grade.

Mr. Hauxwell is attached to the Forest Department of British Burmah, and his appointment will have effect from the 31st December 1880.

No. 216F.—*Mr. M. S. Fowler*, who has been appointed by Her Majesty's Secretary of State to the Forest Department of India, is appointed an Assistant Conservator of Forests of the 3rd Grade.

Mr. Fowler is attached to the Forest Department of the Central Provinces, and his appointment will have effect from the 31st January 1881.

2.—CALCUTTA GAZETTE.—

The 14th January 1881.—*Mr W. M. Green*, Assistant Conservator of Forests, Julpigori Division, has passed in Hindustani by the Higher Standard.

The 16th February 1881.—The following rules for the collection of drift timber in the Sunderbuns forests, under section 51 of the Indian Forest Act, VII of 1878, having been sanctioned by the Lieutenant-Governor, are hereby published for general information:—

I. *Interpretation clause.*—All words used in these rules and defined in Act VII of 1878 (the Indian Forest Act, 1878) shall be deemed to have the meanings respectively attributed to them by the said Act.

And in these rules "drift timber" shall mean timber of the descriptions mentioned in section 45 of the said Act.

II. *Procedure to be used in obtaining permits to collect drift timber.*—Any person who, within the area of the Sunderbuns to which section 45 of the Act has been extended by the Government Notification of the 3rd November 1879, published in the *Calcutta Gazette* of the 19th idem, wishes to save drift timber, shall apply to the officer in charge of the Sunderbuns Forest Division for a written permit specifying the nature of the timber which he wishes to save, and shall register the boat or boats to be used in salving.

Every boat so registered shall have conspicuously painted on it its register number, the date of registration, and a letter indicating the revenue station at which such boat was registered. A fee of Rs. 5 shall be levied for each boat for the first registration, and a fee of one-half this amount for every subsequent registration. Every registration shall hold good for one year from the date thereof. Provided that if any person shall wish to enter the area defined above for the purpose of salving drift timber, the property of himself or of any known owner, a written permit for this special purpose may be granted him by the

officer in charge of the Sunderbuns Forest Division on payment of a fee of Rs. 2 only: but such person shall be bound by all the conditions regarding the registration and marking of his boats laid down in this rule.

III. *Salved timber to be taken to drift timber depôts.*—All timber salved shall be taken, with as little delay as possible, to the nearest drift timber depôt.

IV. *Nothing to prevent chance timber being salved.*—Nothing in the preceding rules shall be held to prevent any person lawfully plying a boat within the limits of the Sunderbuns reserved and protected forests from salving any drift timber that he may find.

V. *Salved timber which may become vested in Government to be sold by auction.*—All drift timber salved under these rules, which may become vested in Government under section 48 of the Indian Forest Act, shall be sold by auction within such periods and in such manner as the Conservator of Forests may direct.

VI. *Amount of salvage (a).*—Any person, whether a Forest Officer or not, who has salved any drift timber, shall be entitled to receive as salvage an amount equivalent to 15 per cent. of the estimated value of such drift timber, as adjudged by the Sunderbuns Divisional Officer or by any subordinate officer specially authorized by the Conservator of Forests in that behalf:

(b) Provided that any person authorized by permit to salve drift timber under Rule II shall receive as salvage an amount equivalent to 25 per cent. of the estimated value of the drift timber salved by him, such value being adjudged as above provided.

(c) In special cases the Conservator of Forests may increase the amount of salvage to a sum not exceeding 50 per cent. of the estimated value of the drift timber salved.

(d) When more persons than one are concerned in salving, the amount of salvage shall be paid to them collectively and on their joint receipt.

VII. *Payments required when drift timber is proved to be the property of a claimant.*—If the drift timber collected shall be shown under section 47 of the Act to be the property of any person other than Government, such person shall be liable to pay to Government, under section 50 of the Act, the following amounts, *vis*:—

- (1) the actual amount of salvage paid to the salvor;
- (2) the actual cost incurred in moving the timber to the drift depôt;
- (3) such fees as may, from time to time, be fixed, with the sanction of Government, for the storing of timber at such depôt.

VIII. *Registration of property marks.*—Any person holding a permit under Rule II who makes use of any property mark or device for marking drift timber salved by him may register the same in the office of the Sunderbuns Forest Divisional Officer. The fee to be paid for such registration shall be 1 rupee for the first year, and eight annas for each annual renewal. A certificate of registration showing the marks registered shall be given on payment of the prescribed fee.

IX. *Penalty clause.*—Any person who shall infringe any of these rules shall be punished with imprisonment for a term which may extend to six months, or with fine which may extend to five hundred rupees, or with both.

The 3rd March 1881.—Mr. W. M. Green, Assistant Conservator of Forests, is allowed privilege leave from the 24th December 1880 to the 8th January 1881, under Section 13, Supplement F., of the Civil Leave Code.

The 8th March 1881.—Under the provisions of section 16 of the Indian Forest Act, VII of 1878, the Lieutenant-Governor hereby appoints the Commissioner of

the Rajshahye and Cooch Behar Division to hear appeals from orders passed by the Forest Settlement Officer in the districts of Darjeeling and Julpigori under sections 10, 11, 14, and 15 of the said Act.

3.—N. W. PROVINCES AND OUDH GAZETTE.—

- No. 3.—*5th January 1881.*—*Messrs. A. F. Broun and F. B. Bryant*, Assistant Conservators, who reported their arrival at Bombay on the 28th December 1880, to the School Circle.
- No. 21.—*11th January 1881.*—*Mr. E. Mc. A. Moir* received charge of the Tonse Forest Division from *Mr. J. C. Murray* on the afternoon of the 18th December 1880.
- No. 36.—*15th January 1881.*—*Mr. E. P. Dansey*, Assistant Conservator, availed himself of the leave granted to him in this department Notification No. 979, dated the 20th October 1880, on the afternoon of the 2nd November 1880.
- No. 39.—*15th January 1881.*—*Mr. E. Fernandez*, Assistant Conservator, joined the Forest School Circle at Ajmere on the 29th December 1880.
- No. 55.—*19th January 1881.*—*Mr. A. Smythies, B.A.*, Assistant Conservator, 2nd Grade, and Officiating Assistant Conservator, 1st Grade, passed by the Higher Standard in the vernacular examination prescribed for forest officers on the 5th November 1880.
- No. 56.—*19th January 1881.*—*Mr. A. Smythies, B.A.*, Assistant Conservator, 2nd Grade, and Officiating Assistant Conservator, 1st Grade, to be an Assistant Conservator, 1st Grade, with effect from 5th November 1880.
- No. 64.—*21st January 1881.*—With reference to Notification No. 3, dated the 5th January 1881, it is hereby notified that *Messrs. A. F. Broun and F. B. Bryant*, Assistant Conservators of Forests, reported their arrival at Dehra Dún on the 9th January 1881.
- No. 78.—*25th January 1881.*—With reference to this Department Notification No. 979, dated the 20th October 1880, *Mr. E. P. Dansey*, Assistant Conservator, reported his return to duty on the forenoon of the 1st January 1881.
- No. 194.—*22nd January 1881.*—The Hon'ble the Lieutenant-Governor is pleased to direct that the following rule be substituted for Rule 5 of the rules for the vernacular examination of forest officers, published by Notification No. 163, dated 6th February 1880 :—
- Rule 5.*—To pass by the Lower Standard, the examinee must obtain at least half marks in each of the three foregoing subjects; and to pass by the Higher Standard, at least three-fourths marks in each.
- No. 86.—*29th January 1881.*—*Mr. O. Greig*, Assistant Conservator, passed the Higher Standard examination on the 5th November 1880.

4.—PUNJAB GAZETTE.—

No. 7*F*.—3rd January 1881.—The Hon'ble the Lieutenant-Governor is pleased, in exercise of the authority vested in him by section 16 of the Indian Forest Act, 1878, to appoint the Commissioner of the Jullundur Division for the time being to hear appeals from the orders of the Forest Settlement Officer in the Kulu Sub-Division of the Kangra District.

No. 13*F*.—10th January 1881.—*Mr. J. C. McDonell*, Deputy Conservator of Forests, is, on being relieved of his duties in the office of the Conservator of Forests, Punjab, by *Mr. H. Leeds*, appointed to the charge of the Plantation Division, *vice Mr. F. D'A. Vincent*.

No. 14*F*.—10th January 1881.—*Mr. F. D'A. Vincent*, Assistant Conservator of Forests, is, on being relieved of the charge of the Plantation Division, attached to the office of the Conservator of Forests, Punjab, with effect from the forenoon of the 21st December 1880, for employment on special demarcation duty.

No. 22*F*.—10th January 1881.—Whereas the Government and the various village communities of the Shahpur Kandi taluka, in the district of Gurdaspur, are jointly interested in the forests mentioned below; and whereas the Local Government is about to undertake the management of the said forests, accounting to the said village communities for their interest therein—

The Lieutenant-Governor is pleased to declare, under section 79 of Act VII of 1878, that the provisions of Chapter II of the Forest Act shall apply to the said forests.

Under Section 4, Act VII of 1878, the Lieutenant-Governor is pleased to declare that it is proposed to constitute as reserved forests, within the limits hereafter specified, lands in the Shahpur Kandi ilaka of the Gurdaspur district.

Mr. J. O. Brown, Assistant Commissioner, is appointed as Forest Settlement Officer to inquire into and determine the existence, nature, and extent of any rights alleged to exist in favor of any person in or over any land within the abovenamed limits, or in or over any forest produce, and to deal with the same as provided by Act VII of 1878.

No. 47*F*.—4th February 1881.—In continuation of *Punjab Government Gazette* Notification No. 22*F*., dated 10th January 1881, the Hon'ble the Lieutenant-Governor is pleased to appoint *Mr. F. D'A. Vincent*, Assistant Conservator of Forests, to be Joint Forest Settlement Officer with *Mr. J. C. Brown* for the purpose described in that Notification.

No. 72*F*.—19th February 1881.—*Mr. S. Copeland* and *Mr. E. G. Spread*, Probationary Sub-Assistant Conservators of Forests, reported their arrival at Lahore from the Forest School, Dehra Dun, on the 31st January and 3rd February 1881, respectively.

Mr. Copeland is posted to the Plantation Division, and *Mr. Spread* to the Rawalpindi Division.

No. 76*P*.—In continuation of *Punjab Government Gazette* Notification No. 912*C*., dated 25th September 1879, the Hon'ble the Lieutenant-Governor is pleased, in exercise of the authority vested in him by section 16 of the Indian Forest Act, 1878, to appoint the Commissioner of Mooltan, for the time being, to hear appeals from the orders of the Forest Settlement Officer of the Montgomery District.

No. 140*F*.—22nd March 1881.—The leave of absence on medical certificate granted to *Mr. E. Sparling*, Deputy Conservator of Forests, in *Punjab Government Gazette* Notification No. 441*F*., dated 29th October 1880, is commuted to special leave.

5.—CENTRAL PROVINCES GAZETTE.—

No. 60.—8th January 1881.—With reference to Notification No. 1171 of 25th March last, *Mr. B. Thompson*, Deputy Conservator of Forests, returned from deputation on special duty to the Mauritius, and assumed charge of the Chanda Forest Division, from *Colonel H. C. T. Jarrett*, Deputy Conservator, on the forenoon of the 4th October last.

No. 284.—26th January 1881.—*Mr. G. F. Taylor*, Officiating Assistant Conservator of Forests, Chanda Forest Division, and transferred to the Direction Division, assumed charge of his duties on the forenoon of the 10th August last.

No. 285.—*Lieutenant-Colonel H. C. T. Jarrett, V.C.*, Deputy Conservator of Forests, 2nd Grade, was attached to the Direction Division, after making over charge of the Chanda Forest Division, on the 4th October last, until his departure on privilege leave on the forenoon of 2nd November last.

No. 286.—*Mr. G. F. Taylor*, Officiating Assistant Conservator, Direction Division, was re-transferred to the Chanda Division, on being relieved by *Lieutenant-Colonel Jarrett, V.O.*, Deputy Conservator, and reported his arrival at Chanda on the afternoon of the 12th October last.

No. 377.—3rd February 1881.—*Mr. W. Jacob*, Deputy Conservator of Forests, assumed charge of the Seoni Forest Division from *Mr. E. D. M. Hooper*, Assistant Conservator, on the forenoon of the 17th December last.

No. 378.—*Mr. H. B. Anthony*, Sub-Assistant Conservator, assumed charge of the Hoshangabad Forest Division from *Mr. E. H. C. Whittall*, Deputy Conservator, on the forenoon of the 20th December last.

No. 379.—*Mr. E. E. Fernandez*, Assistant Conservator, transferred to the Forest School Division, North-Western Provinces, made over charge of the Nimar Forest Division to *Mr. B. H. C. Whittall*, Deputy Conservator of Forests, on the afternoon of the 21st December last.

No. 380.—*Mr. H. Moore*, Assistant Conservator, temporarily transferred to the Chanda Forest Division, made over charge of the Nagpur Forest Division to *Mr. E. D. M. Hooper*, Assistant Conservator, on the afternoon of the 21st December last.

No. 721.—*4th March 1881*.—*Mr. M. S. Fowler*, Assistant Conservator of Forests, attached to the Nimar Division, assumed charge of his duties on the forenoon of the 7th ultimo.

No. 847.—*12th March 1881*.—Three months' privilege leave is granted to *Captain C. W. Losack*, Deputy Conservator of Forests, Mandla Division, with effect from 4th April next, or the subsequent date on which he may avail himself of it.

No. 973.—*25th March 1881*.—*Mr. E. Ludlow*, Assistant Conservator of Forests, is transferred from the Mandla Forest Division, and attached to the Bhandara Forest Division, which he joined on the afternoon of the 11th December last.

6.—ASSAM GAZETTE.—

No. 1.—*5th January 1881*.—The following Rules framed by the Lieutenant-Governor of Bengal, under section 75 (b) of the Indian Forest Act, VII. of 1878, are adopted by the Chief Commissioner of Assam, and published for general information :—

Rules for the grant of rewards to Government Officers and others in cases under the Indian Forest Act.

All non-gazetted Government officers and persons not in the employ of Government are eligible to rewards under these rules.

2. Any Magistrate convicting an offender of any forest offence, or directing the confiscation of any property under section 56 of the Act, may grant, in such proportion as he thinks fit, to any person or persons who have contributed to the seizure of the property or the conviction of the offender, a reward not exceeding the value of the property confiscated, plus the amount of any fine imposed.

3. The forest officer prosecuting the case may, if no reward is granted by the Magistrate, apply to the Magistrate for orders regarding the distribution of fines and the value of forfeitures. In the event of the Magistrate's refusal, reference may be made by the Conservator of Forests to the Local Government.

4. Rewards granted under these rules shall be disbursed at once, if they are less than Rs. 100. If they are over Rs. 100, that sum only will be disbursed at once, and the rest after the period of appeal has expired or the appeal has been rejected. In the event of the conviction being reversed on appeal, the amount paid in rewards shall not be recovered from the persons to whom it has been paid, unless it shall appear that they have acted fraudulently.

5. In cases where, under section 67 of the Indian Forest Act, a forest officer has accepted a sum of money as compensation for any damage which has been committed, the Conservator of Forests may authorise the payment of a portion of the amount realized as a reward to any person who may have contributed to the discovery of the offender.

No. 5.—*10th March 1881*.—In exercise of the powers conferred by section 41 of Act VII of 1878 (the Indian

Forest Act), the Chief Commissioner of Assam is pleased to make, and, with the sanction of the Governor-General in Council, to publish, the following addition to Clause III. of the rules previously in force under Notification No. 20, dated the 10th August 1880, and published at page 456 of the *Assam Gazette*, dated the 14th August 1880. This addition shall come into force from the 1st April 1881:—

Clause III.

(5). For every single dug-out, eight annas.

7.—BRITISH BURMAH GAZETTE.—

No. 2.—*3rd January* 1881.—It being the intention of Government to reserve in the forests of the Arakan Division, which are the property of Government, that is to say, in all waste lands covered with trees or shrubs over which no person has any rights as defined in clauses (a) and (b) of section 6 of the Burmah Land and Revenue Act of 1876, certain kinds of timber, described in the list given below, and to prohibit the felling of this timber except under such rules and regulations as may be hereafter notified, the public are hereby warned to make due provision for any orders which Government may hereafter issue regarding the felling of timber in Government forests, in any contracts or agreements they may enter into for the felling and supply of the timber here named:—

- | | |
|--------------|--------------|
| 1. Teak. | 5. Padouk. |
| 2. Thitka. | 6. Kanyin. |
| 3. Thitkado. | 7. Pyingado. |
| 4. Thingan. | 8. Pyinma. |

The reservation of these trees will take effect from the 1st November 1881.

It is further the intention of Government to make the provisions of Chapter IV. of the Indian Forest Act, 1878, applicable, in the form in which they will be enacted in the Forest Act for Burmah, to Government forest and waste land in Arakan, and to levy from the above-mentioned date a duty on all timber and forest produce extracted for purposes of trade and profit.

No. 2.—*6th January* 1881.—Under the provisions of sec-21 of the Civil Leave Code, *Mr. H. H. Ferrara, B.A.*, Inspector of Schools, British Burma, is granted two years' furlough to Europe, with the usual subsidiary leave.

The 29th January 1881.—The provisions of the Forest Act of 1865 will, from the 1st November 1881, be extended to the whole of the Pegu Division and to the Tenasserim Division west of the Sittang east watershed.

No. 9.—*10th February* 1881.—*Mr. J. Nisbet*, Assistant Conservator of Forests, 2nd Grade, is promoted to the 1st Grade of Assistant Conservators, with effect from the 8th November 1880, the date on which he passed the examination in the Burmese language by the Higher Standard.

8.—MYSORE GAZETTE.—

No. 178.—*14th February* 1881.—*Mr. J. Macpherson*, Deputy Conservator of Forests, Ashtagram Division, is granted furlough to Europe for two years under section 21 of the Civil Leave Code, from the 5th April 1881 or date of departure, with the subsidiary leave allowed by section 35.

No. 193.—*18th March* 1881.—*Mr. J. T. Jellicoe*, Assistant Conservator of Forests, Nagar, is granted privilege leave of absence for 15 days with effect from the 1st April 1881, or from such other date as he may avail himself of it.

No. 28.—*19th March* 1881.—*Mr. M. Muttanna*, Sub-Assistant Conservator of Forests, Coorg, is granted casual leave of 8 days, from the 22nd to 29th March 1881.

9.—BOMBAY GAZETTE.—

No. 5471.—*15th October* 1880.—*Mr. G. A. Hight*, Assistant Conservator of Forests, Ahmednagar, is allowed furlough for one year from 10th December next, or such subsequent date as he may avail himself of it.

No. 5558.—*20th October* 1880.—*Mr. W. A. Talbot*, Assistant Conservator of Forests, Kanara, passed in Kanarese according to the Lower Standard on the 13th instant.

No. 12.—*3rd January* 1881.—*Mr. W. A. Talbot* is promoted from the 2nd to the 1st Grade of Assistant Conservator of Forests, with effect from the 13th October 1880.

No. 255.—*13th January* 1881.—In exercise of the power conferred by section 4 of the Indian Forest Act, 1878, His Excellency the Governor in Council is pleased to appoint *Mr. A. F. Woodburn* to be Forest Settlement Officer in the Khandesh District during the absence of *Mr. J. Pollen*, or until further orders.

The 11th January 1881.—*Mr. George Hawett*, Assistant Conservator of Forests, Khandesh, delivered over charge of his office to *Mr. G. K. Betham*, District Forest Officer, Khandesh, on the 23rd December 1880, after office hours, in order to proceed to the Panch Mahals and join his new appointment there, *vide* Government Resolution No. 6466, dated 8th ultimo, Revenue Department.

The 17th January 1881.—*Mr. Samsher Aga Mirza Aga*, Sub-Assistant Conservator of Forests, Khandesh, returned to duty from the eight month's furlough granted to him in Government Resolution No. 6273, dated 23rd November last, Revenue Department, on the 5th January 1881, after office hours.

No. 400.—*19th January* 1881.—In exercise of the power conferred by Section 4 of the Indian Forest Act, 1878, His Excellency the Governor in Council is pleased to appoint *Rao Bahadur Balkrishna Deorao*, District Deputy Collector in the District of Ahmednagar, to be *ex-officio* Forest Settlement Officer in the Talukas of Nagar, Rahuri, Sheogaon, Nevasa, Karjat and Jamkhed, for the purposes

set forth in section 4, clause (c), and sections 28 and 34 of the said Act.

2. Under section 16 of the said Act His Excellency the Governor in Council is also pleased to appoint the Collector of Ahmednagar to hear appeals from any order passed by the said Forest Settlement Officer under sections 10, 11, 14, or 15 of the said Act.

No. 401.—19th January 1881.—*Mr. B. S. Fagan*, Assistant Conservator of Forests, N. D., passed an examination in Marathi according to the Higher Standard on the 11th instant.

The 19th January 1881.—*Messrs. Waman Ramchandra Gaunde* and *W. J. C. Dunbar*, Assistant Conservators of Forests, respectively delivered over and received charge of the Ahmednagar District Forest Office on the 13th January 1881, before office hours.

No. 540.—26th January 1881.—The following appointments to have effect from the 7th September 1880 are made:—

Mr. S. Hornidge to act as Assistant Conservator of Forests, 3rd Grade, during the absence of *Mr. Right*, or until further orders.

Mr. Waman Ramchandra Gaunde to act as Sub-Assistant Conservator of Forests, 3rd Grade, *vice Mr. Hornidge*.

No. 640.—31st January 1881.—*Mr. Shokiram Pribdas* to act as Sub-Assistant Conservator of Forests in charge of the Jerruck Division, Sind, during the absence on privilege leave of *Mr. Neribdas Jethmal*.

The 7th February 1881.—*Mr. Waman Ramchandra Gaunde*, Acting Sub-Assistant Conservator of Forests, received charge of the office of Sub-Assistant Conservator, Khandedesh, from *Mr. Laxuman Blal Oke*, on the 24th January 1881, before office hours.

No. 1317.—4th March 1881.—*Mr. B. S. F. Fagan*, Assistant Conservator of Forests, 2nd Grade, is promoted to the 1st Grade, with effect from 11th January 1881.

No. 1254.—2nd March 1881.—*Mr. B. S. F. Fagan*, Assistant Conservator of Forests, Sholapur, is allowed privilege leave of absence for three months from such date after the 15th instant as he may avail himself of it.

We regret that as we do not receive the *Madras Gazette*, we cannot publish any notifications from that Presidency.

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